International Energy Agency

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Energy Policies Beyond IEA Countries

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Energy Policies Beyond IEA Countries

INTERNATIONAL ENERGY AGENCY

The International Energy Agency (IEA), an autonomous agency, was established in November 1974. Its primary mandate was – and is – two-fold: to promote energy security amongst its member countries through collective response to physical disruptions in oil supply, and provide authoritative research and analysis on ways to ensure reliable, affordable and clean energy for its 29 member countries and beyond. The IEA carries out a comprehensive programme of energy co-operation among its member countries, each of which is obliged to hold oil stocks equivalent to 90 days of its net imports. The Agency's aims include the following objectives:

- Secure member countries' access to reliable and ample supplies of all forms of energy; in particular, through maintaining effective emergency response capabilities in case of oil supply disruptions.
- Promote sustainable energy policies that spur economic growth and environmental protection in a global context – particularly in terms of reducing greenhouse-gas emissions that contribute to climate change.
- Improve transparency of international markets through collection and analysis of energy data.
- Support global collaboration on energy technology to secure future energy supplies and mitigate their environmental impact, including through improved energy efficiency and development and deployment of low-carbon technologies.
- Find solutions to global energy challenges through engagement and dialogue with non-member countries, industry, international organisations and other stakeholders.

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1. EXECUTIVE SUMMARY AND KEY RECOMMENDATIONS

EXECUTIVE SUMMARY

Indonesia's economic and political development since the Asian financial crisis and its transition to democracy are a success story. The country has achieved consistently high growth rates over the last 15 years, and it has joined the G20, stabilised its young democracy, and devolved decision making and budgetary power to the local level.

Indonesia remains a net energy exporter. It is the largest coal exporter globally and the largest exporter of gas and liquid biofuels regionally. Apart from oil and oil products the country is energy independent. The expansion of its coal, palm oil and biomass production, as well as a substantial increase in the exploitation of the archipelago's renewable energy potential, have helped this process.

Nonetheless, amid dwindling oil and gas reserves and production, a lack of exploration, and ageing refineries, Indonesia is increasingly dependent on imported oil supplies and has become the second-largest oil importer in the region. The country is faced with a considerable bill to finance subsidised end-consumer prices, which are a legacy of its times as a net oil exporter.

Indonesia's economic success, rising living standards, population growth and rapid urbanisation have increased energy consumption rapidly. IEA projections predict this trend to continue. Hence, energy security and meeting expected energy demand growth are the key challenges for Indonesia's energy policy.

The continuation of Indonesia's economic, political and social success story depends on its ability to deliver sustainable and sufficient energy supply to markets and ultimately to consumers. Meeting demand growth and ensuring the environmental sustainability of energy supplies must remain key pillars of its economic and investment policies and strategies. This will require further improvements to Indonesia's institutional set-up, alongside stronger policy planning and implementation, more investment in critical energy infrastructure, and continued movement towards regulated energy markets and cost-reflective pricing.

SUBSTANTIAL PROGRESS

Indonesia has already started this process and has been successful in implementing important changes. Its energy policy framework has been transformed considerably, and the government has implemented many of the recommendations from the previous and first IEA *Energy Policy Review of Indonesia*, which was published in 2008.

In particular, the government of Indonesia enacted a number of important energy policies, such as the 2007 Law on Energy, the 2009 Law on Electricity, the 2009 Law on Mineral and Coal Mining, and the 2014 National Energy Policy.

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Indonesia has also enhanced its institutional environment by establishing a Policy and Planning Unit within the National Energy Council (NEC) and a Directorate-General of New, Renewable Energy and Energy Conservation (DGNREEC) within the Ministry of Energy and Mineral Resources (MEMR).

The new Policy and Planning Unit has allowed the NEC to strengthen its capacity to model and plan energy policy in co-ordination with all involved institutions. This has helped focus Indonesia's national energy planning, including the introduction of ambitious targets for renewable energy.

From this basis, DGNREEC, in co-operation with the Ministry of Finance, succeeded in establishing incentives for renewable energy development which helped attract private investors and open up the electricity market. The feed-in tariffs provide an important tool for realising Indonesia's renewable energy potential. The conclusion of a Memorandum of Understanding between MEMR and the Ministry of Forestry has facilitated geothermal exploration in forest areas, which is crucial to ensure that Indonesia begins using its massive geothermal potential.

MEMR has improved the quality of its data for oil and gas block tenders, as well as the transparency of the tendering process. This has been a step in the right direction and will serve to increase interest in oil and gas exploration in Indonesia.

The government has also built on its climate change commitments, introducing not only an updated carbon inventory, but also submitting its Second National Communication to the United Nations in 2010. On energy efficiency and conservation, Indonesia has established the necessary planning and policy documents and has started developing energy efficiency standards for buildings, appliances and industry.

Concerning energy subsidies, Indonesia has continued to reform the end-user tariff structure in the electricity sector and introduced staged price increases in 2013 and 2014. The government also decreased subsidies for gasoline and diesel in 2008, and in 2013 and in 2014 increased end-consumer prices substantially as the cost of the subsidy keeps rising.

IMPROVE AND STREAMLINE INSTITUTIONS AND POLICIES

Despite progress in some sectors since the 2008 *Energy Policy Review of Indonesia*, the country's policy and institutional environment continues to lack coherence and could benefit from a clearer definition of responsibilities, improved co-ordination and greater market orientation. Indonesia's energy policy suffers from the involvement of too many institutions and agencies with overlapping roles. In particular, the co-existence of ministries, councils and task forces, each charged with co-ordinating policy implementation in the same sector, complicates rather than facilitates policy formulation and implementation. No clear responsibility for policy formulation and implementation exists. This has led to an environment where no single point of responsibility exists for the delivery of policy goals and no institution can be held accountable when goals are not reached in time.

This has led to policy goals that are sometimes too ambitious and which reflect political priorities rather than achievable targets. While energy policies should be ambitious, they must be founded on reliable data, sophisticated economic modelling, and past experience of the implementation capacity of the responsible actors. The goal of reaching a 23% renewable energy share in the energy mix by 2025 is a case in point.

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Different national plans and policies promote energy development, for example, the National Energy Policy, the Masterplan for Acceleration and Expansion of Indonesia's Economic Development, and others. Often these policies are not updated in parallel, with the result that some seem to promote different goals. This inconsistency is reflected in sectoral policy plans that do not always use the latest scenarios or end-goals, a consequence of general confusion about official or higher-level goals.

This cannot only be attributed to the multiplicity of institutional actors, the high number of ministries (34), and the numerous sectoral councils, task forces and co-ordination bodies, but also to the ongoing decentralisation of institutions. Policies and regulations at central and local level must be consistent: Indonesia needs to ensure national standardisation of district regulations and legislation.

One means to address this problem could be to update the 2007 Energy Law to delineate clearly the responsibilities of central-level institutions, and ensure that district-level regulations are required to conform to national framework legislation on energy policies and laws.

ENHANCE THE LEGAL AND REGULATORY ENVIRONMENT

Despite the progress Indonesia has made in its transition from a centrally planned economy towards a market-based economy, the legal and regulatory framework needs further improvement if the country is to attract the investment necessary to continue to develop and sustain its energy sector.

Regulations are introduced that contrast with existing policies and/or are in direct conflict with existing laws. Diverging regulations at central and local levels for extractive industries are the most visible but by no means the only cases. This is a serious challenge for private investors, for it affects certainty regarding interpretation of rules and regulations.

Private investment relies on clear and transparent rules and a reasonable degree of confidence about the future. Indonesia urgently needs to clarify the rules, regulations and tax regimes for investors engaged in the natural resource extraction sector as well as in the electricity generation sector.

A key element of this is the establishment of independent institutions – or at least two ring-fenced units within the government that are not part of or directly answerable to any ministry – for the regulation of the upstream oil and gas sectors, the downstream oil and gas sectors, and the electricity sector.

The Anti-Corruption Commission (KPK) could serve as an organisational model for an independent institution that remains part of the state. The present integration of the sector regulators into the Ministry of Energy, or into the state-owned companies, has created conflicts of interest vis-à-vis the setting and enforcement of rules.

IMPROVE AND EXTEND INFRASTRUCTURE

The delivery of suitable infrastructure is at the heart of Indonesia’s challenge to reach its ambitious energy mix objectives, increase energy production and ensure demand growth can be met.

The planned increase in renewable energy production relies on large investments in the transmission grid alongside investment in geothermal, solar and wind generating capacity.

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Similarly, the establishment of a domestic gas market needs additional gas transport infrastructure in order to be able to re-direct gas from the export market. The domestic coal sector stands to benefit from the implementation of long-standing plans to build coal transport railways, and the electricity sector needs additional transmission lines.

Indonesia's policies and plans identify these infrastructure projects but their development is often delayed and the funding sources unclear. Without new infrastructure, Indonesia risks electricity black-outs in the coming years and a higher energy bill as a result of greater reliance on imports.

Another key concern relating to investment in infrastructure is land acquisition. Investment projects, whether funded by the public or private sector, are often delayed because of a lack of clarity on land ownership and poor procedures for land acquisition for priority projects. Indonesia needs to develop – in consultation with all stakeholders, including landowners – a comprehensive land law that replaces all of the overlaps, contradictions and ambiguities in existing laws, regulations and procedures. Each sector's laws and regulations should then be aligned with this umbrella legislation. Meanwhile, Indonesia needs to provide government support to investors to ensure that critical energy infrastructure can be built via a fast-track mechanism for land acquisition that respects the rights of local communities and landowners.

Overall, Indonesia needs to strengthen its support for investment in critical energy infrastructure and significantly enhance co-ordination between all state actors. The Investment Board should be strengthened and a one-stop-shop for co-ordinating renewable energy, electricity and natural gas infrastructure investment established within it. This will guide investors through the process of obtaining the necessary permits for construction of energy infrastructure on each of the district, regional and central levels.

PHASE OUT SUBSIDIES AND MOVE TO MARKET PRICING

Energy subsidies are holding back Indonesia's transition to a sustainable energy system in a number of ways. First, subsidies take much-needed resources from the state budget that could be used to fund critical energy infrastructure (see above) and health, education and other programmes.

Subsidies also discourage the conservation of energy and the switch to cleaner alternatives, thereby impeding the achievement of Indonesia's National Energy Policy goals and further increasing its dependence on energy imports.

The introduction of cost-reflective market pricing for all energy products is a crucial step if Indonesia is to meet its energy goals, including reducing the share of oil in the energy mix and increasing renewable energy production, as well as attracting investment in critical energy infrastructure.

Rather than responding only to short-term budgetary and debt pressures, the government should aim to introduce fluctuating prices and implement a step-by-step phase-out of subsidies, rigorously sticking to its timetable.

Clearly, any phase-out will have short-term negative effects in the form of increases in the cost of living and inflationary pressures. The government needs to ensure the availability of compensatory measures to support the poorest households.

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Given past resistance to subsidy reform, the government needs to devise a clear political strategy regarding subsidy phase-out, communicate explicitly the steps it intends to take, provide transparency on the usage of saved expenditure, and compensate people living in poverty or at risk of falling into poverty again.

ENSURE THE SUSTAINABILITY OF THE ENERGY SECTOR

It is clear that the phase-out of energy subsidies will increase the sustainability of the energy sector, encourage energy conservation and spur more efficient use of transport. It will also free up funding to support the promotion and connection of renewable energy.

Furthermore, increasing the sustainability of the energy sector is crucial to ensure that Indonesia reaches its greenhouse gas (GHG) emissions reduction target. This will require the adoption of new and more efficient technologies in the transport and electricity generation sectors. Clean coal technologies are critical in this respect, given the projected increase in coal-fired power generation in Indonesia.

Environmental protection also needs to be enhanced, especially at local level, if the destruction of Indonesia's forests and biodiversity is to be halted. The application and enforcement of existing regulations is of vital importance. Unless the extraction of Indonesia's natural resources are done in a sustainable manner, Indonesia risks losing its substantial natural capital in return for short-term gains.

ESTABLISHING A DOMESTIC GAS MARKET

Indonesia's intention to establish a domestic gas market, an important element of this review, is facing all of the obstacles described above. It will be a key test of the government's ability to overcome the apparent policy and regulatory challenges and to establish gas as a bridging fuel towards a more sustainable energy sector.

First, the government needs to address the lack of integrated long-term policy planning; the extensive lead times for infrastructure investments, construction and commission; and the lack of co-ordination between the market sectors – including the power sector – as well as the physical constraints and bottlenecks.

Second, the transmission network needs to evolve to facilitate the emergence of a transparent domestic wholesale gas market. Oversight and co-ordination of the gas transport sector need to be placed with an independent, well-resourced regulator. It should be tasked with overseeing the long-term development of the sector, as well as with the implementation of a transparent transmission access and pricing regime.

Finally, the government needs to reform the mandatory allocation of gas supply and regulated (subsidised) prices. In their place, it should gradually introduce a transparent and predictable natural pricing regime and bring domestic wholesale gas prices closer to export levels.

KEY RECOMMENDATIONS

The government of Indonesia should:

- ☐ *Resolutely decrease fossil fuel subsidies by implementing its existing phase-out timetable and starting a large-scale and long-term communication campaign on the*

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necessity, timeline and the reallocation of state expenditures, including compensatory measures for the poor, and social and infrastructure development investments that benefit the entire population.

- *Step up co-ordination in energy policy making and regulation; ensure consistency between modelling scenarios, targets, and implementation; and focus on the quality of legislative and regulatory processes by clarifying competencies, enhancing stakeholder consultations, defining deliverables and assigning accountability at national and sub-national levels.*
- *Improve the energy investment framework by speeding up decision making and opening the energy sectors to market-based mechanisms for prices and fuel choices.*
- *Establish a single office within the Investment Coordination Board to facilitate infrastructure investments in renewable energy, electricity and natural gas, which would which would advise and support investors in obtaining the necessary permits and licences from central and local institutions.*
- *Develop and implement an integrated, long-term development plan for natural gas infrastructure, reform wholesale natural gas pricing and allocation mechanisms, and establish an independent downstream regulator for natural gas and electricity, with the long-term goal of a national wholesale market and more efficient use of gas.*

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PART I
POLICY ANALYSIS

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2. GENERAL ENERGY POLICY

Key data (2012)

TPES: 213.6 Mtoe (oil 36.1%, bioenergy, biofuels[1] and waste 25.3%, coal 13.9%, geothermal 7.6%, hydro 0.5%), +29.3% since 2002

TPES per capita: 0.9 toe (IEA average: 4.5 toe)

TPES per unit of GDP: 0.11 toe/USD 1 000 PPP (IEA average: 0.14 toe/USD 1 000 PPP)

Electricity generation: 195.9 TWh (coal 48.7%, natural gas 23.2%, oil 16.7%, hydro 6.5%, geothermal 4.8%, biofuels and waste 0.1%), +81% since 2002

Electricity per capita: 0.8 MWh (IEA average: 10.1 MWh)

COUNTRY OVERVIEW

Indonesia is an archipelago state combining 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.

The country extends 5 120 kilometres (km) from east to west and 1 760 km from north to south. Its total land area is 1 919 317 square kilometres, making it the world's fifteenth-largest country.

With approximately 250 million inhabitants, Indonesia is the world's fourth most populous nation. More than 50% of the population, however, is located on Java, whereas the bulk of energy resources are located on the other islands far away from population centres.

The distances between the location of resource wealth and population centres represent a major challenge to meeting the energy needs of a growing economy characterised by urbanisation and population growth, especially since demand is concentrated in large cities, many of which are located in Java.

ECONOMY

Indonesia is the largest economy in Southeast Asia, the sixteenth largest globally, and a member of the G20. The country recorded an average growth rate of 5.7% between 2000 and 2012, which was accompanied by an increase in gross national income per capita from USD 2 200 in 2000 to USD 3 563 in 2012. The government aims to transform Indonesia into one of the top ten economies globally and increase per capita income from USD 3 563 to USD 15 000 by 2025 (World Bank, 2014).

1. The category "Biofuels and waste" is an official statistical category that includes solid biofuels (commonly referred to as "solid biomass"), biogases, liquid biofuels and the renewable portion of municipal waste (for more details see www.iea.org/statistics/resources/balancedefinitions/). This publication uses the term "biofuels for transport" for liquid fuels derived from organic material, including biodiesel and ethanol that are used as fuel in the transport sector.

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The economy has managed an impressive recovery since the Asian financial crisis in 1997 and 1998, moving away from a predominantly export and commodity-oriented economy to one sustained by domestic demand and characterised by a switch from agricultural products to a manufacturing and services base.

Exports of natural resources and energy have been accounting for a steadily declining share of the economy, as industrial production has expanded. Their share of gross domestic product (GDP) decreased from 35% in 2000 to less than 25% in 2012, reflecting a significant increase in domestic demand. Exports of goods and services grew at an average of 8.2% per year between 2002 and 2012, and mining's share of exports increased from 25% to some 30%. (McKinsey, 2012; World Bank, 2014)

It is important to remember that, despite impressive growth, more than 32 million Indonesians live below the poverty line, and approximately half of all households remain clustered around the national poverty line, set at about USD 22 per month. In addition, employment growth has lagged behind population growth, and public services remain inadequate according to the World Bank indicators for middle-income country standards. Indonesia is also performing poorly in a number of health- and infrastructure-related indicators and, as a result, may fail to reach some Millennium Development Goals (MDG) 2015 targets (World Bank, 2014).

INSTITUTIONS

Following the political unrest triggered by the Asian financial crisis in 1997 and 1998, Indonesia returned to a constitutional, presidential democracy via four amendments to the 1945 constitution.

Prior to 1998, the highest state institution was the People's Consultative Assembly (MPR). It consisted of 500 members of the House of Representatives plus 200 non-elected members representing the provinces, along with professional and military associations. The MPR served a five-year term, but in the absence of an emergency met only once to appoint the President and the Vice President and sets the guidelines for state policy.

Nowadays the legislature is made up of two bodies: the unicameral House of Representatives (DPR) and the Regional Representatives' Assembly (DPD), which is mandated to deal with regional affairs. The members of both DPR and DPD are designated by a general election every five years. It is the principal legislative institution and oversees the direction of the government and, along with the government, drafts regulations and laws.

The executive branch is headed by the president, who serves as head of state and head of government. The president is elected in a direct general election every five years.

The highest judicial bodies are the Constitutional Court and the Supreme Court. The former has the final word in reviewing laws concerning the constitution, disputes over the authority of state institutions, the dissolution of political parties and disputes over election results.

The structures at regional and local levels in the 34 provinces and 410 regencies are similar to the central government. A governor heads a province, while the regency or municipal level of government is headed by a regent or mayor. Regions have acquired substantial autonomy over budget and policy since 2001, which has increased the complexity of Indonesia's political and economic governance, as the country is still in the process of establishing clear and transparent guidelines for decision making between central, regional and local governments.

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SUPPLY AND DEMAND

Indonesia is a major fossil fuel producer and exporter; its total primary energy supply (TPES) amounts to a mere 55% of its production. It is the world's largest coal exporter (and the fourth-largest coal producer), the seventh-largest liquefied natural gas (LNG) exporter (tenth-largest gas producer) and the world's largest producer of biofuels. Formerly a large exporter of crude oil and member of Organization of the Petroleum Exporting Countries (OPEC) until 2008, Indonesia became a net oil importer in 2004 as production declined and demand rose.

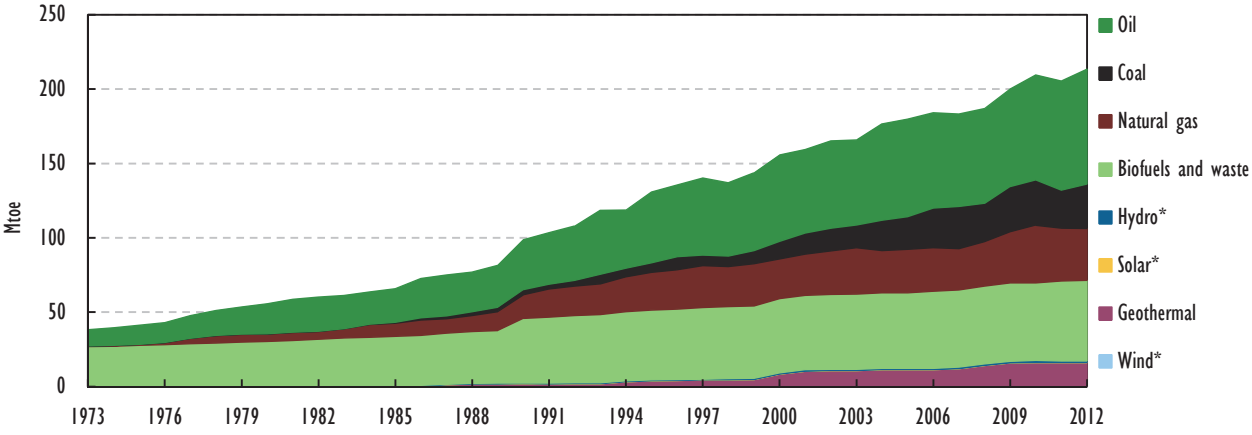
The shift from oil exporter to importer and the foreseeable need to import LNG to Java from peripheral Indonesia and overseas has increased government concerns about energy security, even over abundant resources such as coal. Policies have increasingly focused on securing energy production for domestic demand through resource management, cost/benefit analysis of development for export as against domestic use, promotion of renewables, and energy efficiency.

PRODUCTION AND SUPPLY

TPES has been growing at an annualised rate of 2.6% between 2002 and 2012 (with contractions during the Asian crisis and in 2011) and reached a record high of 213.6 million tonnes of oil-equivalent (Mtoe) in 2012, increasing by 4% compared to the previous year. TPES increased by a total of 29.3% between 2002 and 2012.

Oil is the largest source of energy supply in the country, accounting for 36.2% of TPES in 2012. Bioenergy, biofuels and waste represented a further 25.3%, followed by natural gas (16.4%) and coal (13.9%). Geothermal accounted for 7.6 %, while around 0.5% was supplied from hydro (Figure 2.1).

Figure 2.1 TPES, 1973-2012



* Negligible.

Source: IEA (2014a), *Energy Balances of Non-OECD Countries 2014*, OECD/IEA, Paris.

Together, fossil fuels represent 66.5% of TPES, while renewable energy sources account for the remainder. When compared to IEA member countries, Indonesia ranks seventh-lowest with regard to the share of fossil fuels in TPES (Figure 2.2).

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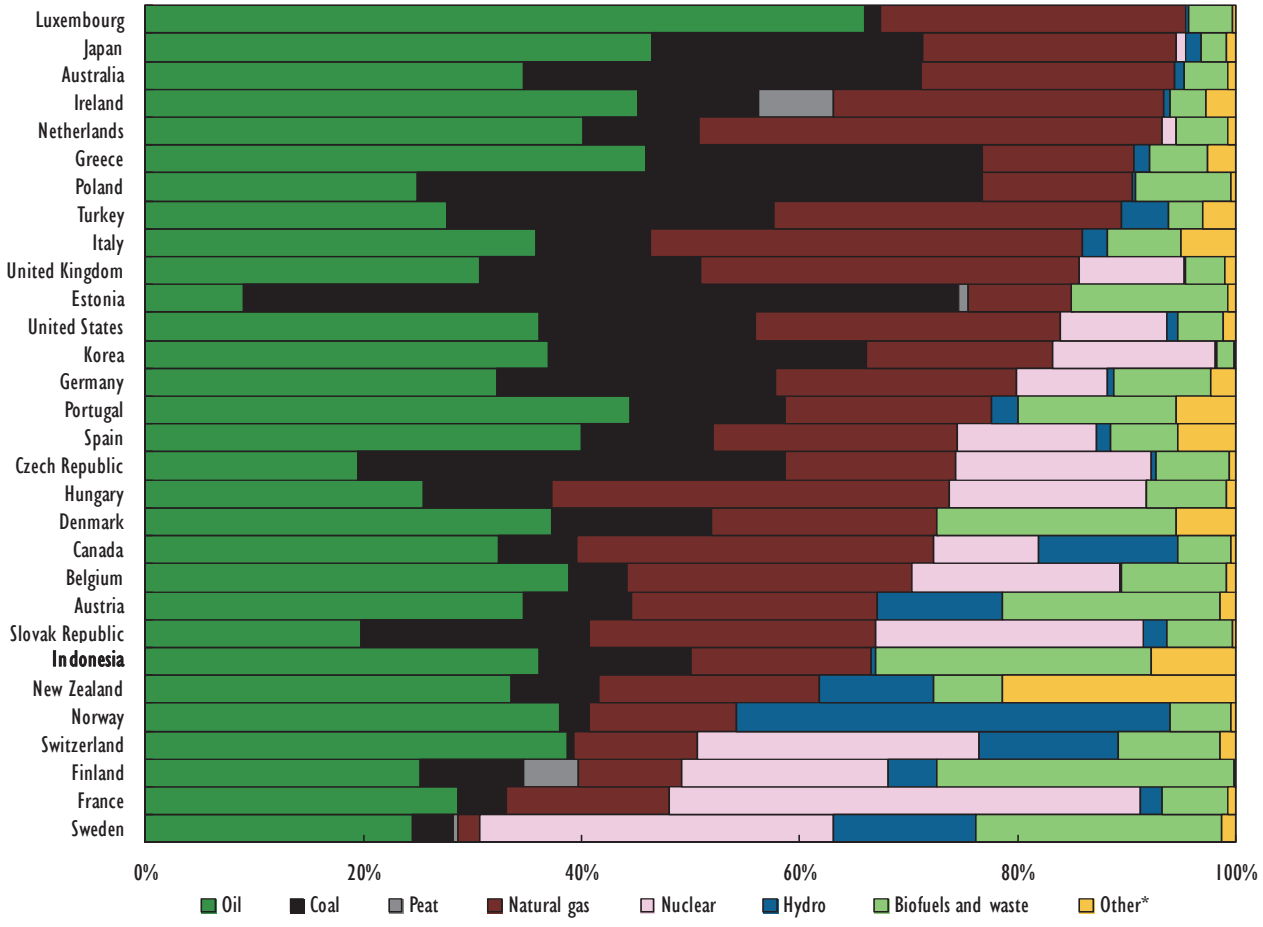
Over the decade to 2012, Indonesia's energy mix has seen slow growth in biofuels and waste and the doubling of the supply of coal. As such, the share of biofuels and waste in TPES declined from 30.4% in 2002 to 25.3% in 2012, while the share of coal increased from 9.3% in 2002 to 13.9% in 2012.

Figure 2.2 Breakdown of TPES in Indonesia and IEA member countries, 2012



* *Other* includes geothermal, solar, wind, and ambient heat production.

Sources: IEA (2014a), *Energy Balances of Non-OECD Countries 2014*, OECD/IEA, Paris; IEA (2014b), *Energy Balances of OECD Countries 2014*, OECD/IEA, Paris.

Despite falling oil production, Indonesia remains a significant producer of energy, with total energy production of 440.2 Mtoe in 2012. Coal accounts for 58.1% of all production, followed by natural gas (15.3%), biofuels and waste (12.6%), oil (10.1%) and geothermal (3.7%). The country also produces hydro, wind and solar, albeit at less than 0.5% of production.

Coal production has increased more than fourfold since 2002 from 58.3 Mtoe to 255.7 Mtoe, while growth in natural gas production has been slower, up by 3.6% from 64.9 Mtoe in 2002 to 67.3 Mtoe in 2012. Conversely, the production of crude oil has fallen by 30%. Electricity production from geothermal and bioenergy has also increased, by 51% and 10.1%, respectively. Wind power generation began in 2009, while solar power started in 2010.

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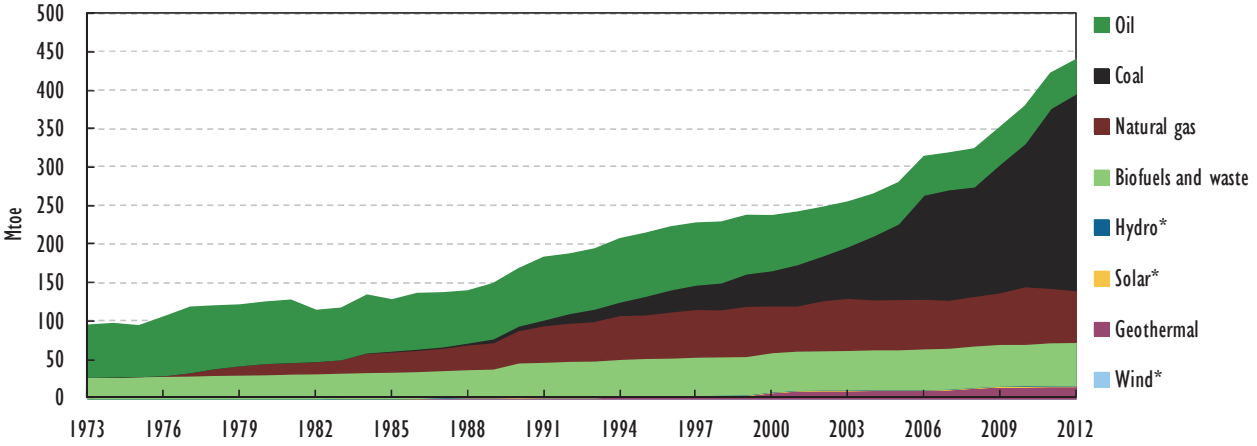
Total energy exports amounted to 279 Mtoe in 2012, made up of coal (81%), natural gas (11.6%), crude oil (5.5%) and oil products (1.5%). Exports have increased by 142% in the ten years to 2012, growing twice as fast as production, which increased by 77.3% over the same period (Figure 2.3).

Imports totalled 52.8 Mtoe in 2012, made up of crude oil (37.6%) and oil products (62.4%). Imports to Indonesia have increased by 50.7% in the ten years since 2002, filling the gap between growing demand for oil and falling production.

Figure 2.3 Energy production by source, 1973-2012



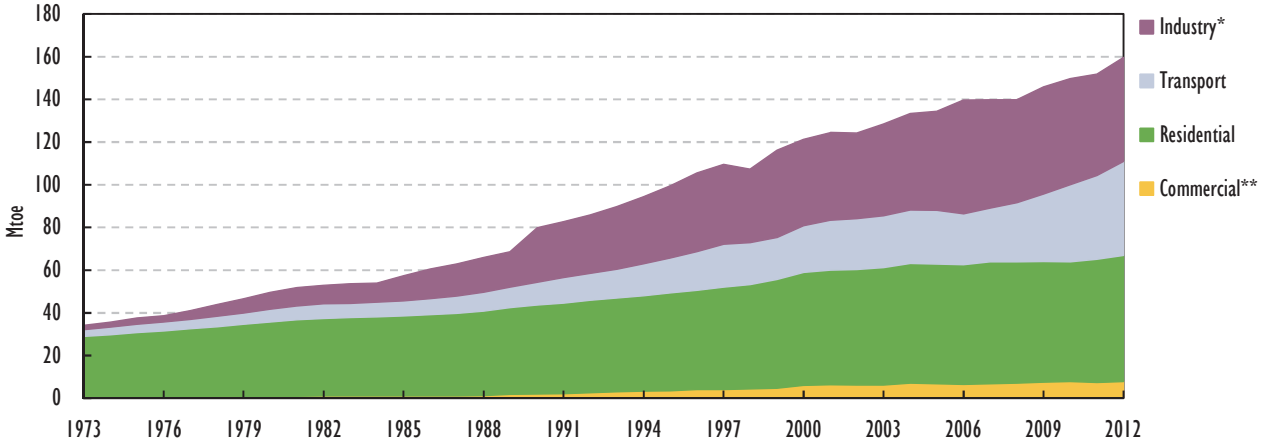
* Negligible.

Source: IEA (2014a), *Energy Balances of Non-OECD Countries*, OECD/IEA, Paris.

DEMAND

Total final consumption (TFC) of energy reached a record high of 159.7 Mtoe in 2012. This is 28.6% higher compared to 2002. The residential sector is the largest consumer of energy, with a share of 37% of TFC. Industry accounts for 30.5%, followed by transport with 27.6%. The smallest consuming sector is commercial services, with a share of 4.9% of TFC (Figure 2.4).

Figure 2.4 TFC by sector, 1973-2012



* *Industry* includes non-energy use.

** *Commercial* includes commercial and public services, agriculture/fishing and forestry.

Source: IEA (2014a), *Energy Balances of Non-OECD Countries 2014*, OECD/IEA, Paris.

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In the ten years to 2012, the transport sector saw the fastest-growing demand. Demand from households increased by only 9.2% over the period, while demand from transport grew by 85.6%.

INSTITUTIONS

INDONESIAN GOVERNMENT INSTITUTIONS

The **Ministry of Energy and Mineral Resources** (MEMR) is the principal actor in the governance of the energy and mining sector. It oversees policy making, implementation and technical policy, manages energy and mining assets and evaluates the performance of the sector. MEMR is divided into four Directorate Generals (DGs) with responsibility for: oil and gas; electricity; mineral and coal mining; and new and renewable energy and energy efficiency. The establishment of the latter follows a recommendation from the previous *Energy Policy Review of Indonesia* (IEA, 2008).

In addition, MEMR has three agencies: the Agency for Research and Development, which focuses on energy and mining-related technologies and research; the Geological Agency, which focuses on mapping geological resources, volcanology and disaster mitigation measures; and the Education and Training Board, which focuses on the continuous development of the ministry's staff.

The **National Energy Council** (NEC) was established in 2007 as the principal energy co-ordination body. It brings together the seven ministries indirectly involved in the energy sector (i.e. those described below). The NEC is chaired by the President and Vice President. The Minister of Energy and Mineral Resources serves as Executive Chairperson. The NEC is composed of members from the seven ministries described below and eight representatives from stakeholders. The NEC designs and formulates the National Energy Policy, decides measures to manage energy crises and emergencies, and monitors the implementation of energy policy. Ministerial members are appointed by the President, while the others are selected by the House of Representatives.

The **Co-ordinating Ministry for Economic Affairs** is one of four co-ordinating ministries. It reports directly to the President and Vice President. Its task is to simplify, manage and co-ordinate issues that concern more than one ministry, particularly related to infrastructure development and regional allocation of resources. Fifteen ministries, including the Ministry of Finance, come under the supervision of the Co-ordinating Ministry for Economic Affairs.

The **Ministry of National Development Planning** (BAPPENAS) is responsible for the preparation of the national development planning processes. BAPPENAS is responsible for macroeconomic planning; economic development; infrastructure, energy and human resource development; regional development and natural resource management; law, defence and civil development; and national spatial planning and land policy.

The **Ministry of Finance** (MoF) manages the state's fiscal and financial assets and properties, and formulates the state budget, taxation, customs and excise policies. With regard to energy, the MoF is engaged in the management of energy subsidies, the setting of renewable energy tariffs, and the taxation of energy products, energy infrastructure and operations.

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The **Ministry of Environment** (MoE) establishes and enforces environmental standards and regulations. It sets the environmental standards for resource extraction in the coal mining, oil and gas sectors.

The **Ministry of Forestry** is responsible for the management of Indonesia's large but declining forests, thereby implicitly overseeing 70% of Indonesia's land area. It is a key actor in infrastructure projects that rely on land acquisition. It also has oversight over plantations and mining concessions in forest areas.

The **Ministry of Transport** (MoT) is responsible for policies relating to all modes of transport by road, rail, sea and air. This includes the provision of services, infrastructure and communications facilities, and maintenance.

The **Ministry of Industry** (MoI) promotes the establishment and development of industrial activities and companies in Indonesia. In this regard, it participates in the governance of the transport sector, regulating technical specifications for vehicles and tax breaks for certain types of vehicle, and promoting the country's industrial competitiveness by improving the investment environment.

Commission VII of the Indonesian House of Representatives is the principal parliamentary body dealing with energy matters. It reviews and approves the National Energy Policy as well as any change in the level of Indonesia's electricity and fuel subsidy regimes.

DECENTRALISED GOVERNANCE

Following the end of the Soeharto regime and the switch to a democratic multi-party system, Indonesia decentralised its political system in 1999. In 2001, Indonesia implemented what is commonly referred to as the "Big Bang" of decentralisation, thereby transferring decision-making power and budgetary resources to provinces, regencies, cities and villages.

This process divided Indonesia into 34 provinces, 99 cities, 410 regencies, 6 543 districts, and 75 244 villages. These 82 330 local government units acquired distinctive rights and responsibilities related to energy sector governance and policy making.

Decentralisation went hand-in-hand with the reallocation of revenue sharing between central and local government. Regional governments receive 15% of the net revenues from oil and 30% of the net revenues from natural gas. Of the 15%, 6% will go to the regency of origin (where the production sharing contract signed between the government and the companies is located), 6% will be shared among the other regencies in the province, and 3% will go to the provincial government. The same relative shares apply to gas revenues: 12% to the regency of origin, 12% among the remaining regencies, and 6% to the provincial government.

The royalties from coal mining are paid to the central government and then allocated according to the following formula: 20% for central government, 16% for the provincial government, 32% for the district government, and 32% disbursed across the other district governments in the same province.

It is important to note that regional governments have the right and responsibility to approve plans of development in the upstream sector, issue concessions, permits, and licences for coal mining and renewable energy projects as well as land rights. Most local governments, however, have very limited capacity or understanding of the implications

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of various energy scenarios. There is no established policy framework through which to encourage local governments to pursue renewable energy initiatives.

OTHER INDONESIAN GOVERNMENT AGENCIES, REGULATORY INSTITUTIONS AND STATE-OWNED ENTERPRISES

SKK MIGAS stands for a Special Task Force for Upstream Oil and Gas Business Activities. It was established as a successor to the previously independent oil and gas regulator BP MIGAS, which was declared unconstitutional in late 2012. SKK MIGAS, created shortly after, sits under MEMR and manages upstream oil and gas activities by signing and monitoring upstream oil and gas co-operation contracts. It also reviews and submits the plan of field development, approves work programmes and budgets, and monitors the performance of the oil and gas contracts.

BPH MIGAS is the downstream regulator for oil and gas. It regulates and supervises the downstream oil and gas industry, and retail fuel distribution and supply.

Pertamina is the state-owned oil and gas company. It is the country's second-largest oil producer with 19% of total output after Chevron. It also produces 17% of the country's gas. Pertamina is also engaged in LNG and refining activities, and owns the largest fuel distribution network in Indonesia. Pertamina has expanded into geothermal exploration and exploitation. In 2013, Pertamina was ranked 122 in the Fortune Global 500 of global companies, ranked by revenues.

PLN is the state-owned electricity company that is vertically integrated and holds a monopoly over distribution.

The **Investment Co-ordinating Board** (BKPM) is tasked with attracting foreign sector investments to Indonesia, including into energy infrastructure.

The **Infrastructure Guarantee Fund** (IGF) appraises structures and provides guarantees for public-private partnership (PPP) infrastructure projects.

GOVERNANCE AND TRANSPARENCY

The **Audit Board** of Indonesia conducts audits on all state funds managed by central, provincial and local governments, state-owned enterprises, the central bank, public service organisations and other parties who manage state finance. In that function it also provides transparency on fraud, corruption, smuggling, illegal logging and abuse of power in the energy and coal mining sectors.

The **Anti-Corruption Commission** (KPK) provides a further layer of anti-corruption activity, and has increasingly targeted the energy and mineral resource sectors to promote transparency and good governance.

The **Extractive Industries Transparency Initiative**, which Indonesia joined as a compliant country in 2014, will further increase the transparency of the natural resource sectors.

ENERGY POLICIES

CONSTITUTION

Article 33 (2) of the constitution states that "sectors of production which are important for the country and affect the life of the people are under the powers of the State".

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Article 33 (3) specifies that "the land, the waters and natural resources within are under the powers of the State and shall be used to the greatest benefit of the people".

Article 33 has been invoked frequently to prevent change in energy governance and has been interpreted by the Constitutional Court to stop the establishment of independent regulators, roll back the liberalisation of Indonesia's energy markets, and prevent the unbundling and privatisation of state-owned companies involved in energy production, as well as hinder the phase-out of energy subsidies.

ENERGY LAW (EL7)

In 2007, the government established a specific legal basis for national energy management, with the adoption of Energy Law No. 30 2007 (EL7). The law spells out general principles for the management of energy resources and the government's basic targets for the future development of the energy mix. In particular, it laid the foundation for regulations on the development of renewable energy and energy conservation.

EL7 codified the institutional structure for energy management, establishing the NEC, and specified the distribution of prerogatives between central government, Parliament, and regional and local authorities.

Compared to other sectoral laws, EL7 provided considerable power to Parliament; as approved by government, the National Energy Policy needs consent of Parliament. In addition, it stipulates that the House of Representatives approves international energy agreements and selects the members of the NEC.

Regional and local governments are given the power to develop regional master plans and regulations on energy. This includes the granting of licences for coal mining and renewable energy exploitation as well as the supervision of local enterprises, including the regional and local offices of the state-owned electricity company PLN.

NATIONAL ENERGY POLICY (NEP)

EL7 mandated the NEC to draft a National Energy Policy (NEP)[2] and update it every four to five years. Nonetheless, Indonesia was operating under NEP 2006 until 2014. Parliament adopted a revised NEP in February 2014 (NEP14), which was signed on 17 October 2014 as The Government Regulation No.79/2014.

NEP14 introduces a number of important changes to energy policy planning. It focuses on re-establishing Indonesia's energy independence by re-directing energy resources from export to the domestic market, and aims to rebalance the energy mix towards indigenous energy supplies. This translates into minimising oil consumption, increasing the exploitation and consumption of renewables and coal, optimising gas production and consumption, and consideration of nuclear energy as the option of last resort. NEP14 sets out the ambition to transform the energy mix by 2025 as follows: 30% coal, 22% oil, 23% renewable resources and 25% natural gas (Figure 2.5). The sheer challenge of this target becomes even more striking when translated into absolute figures. Use of gas is to more than double, use of coal is to more than triple, and renewables are to grow more than eleven-fold by 2025. This includes decreasing energy elasticity as a function of GDP to below one by 2025 and a focus on energy efficiency measures.

2. The National Energy Policy targets are formulated on the basis of Indonesia's own energy data and balances which exclude traditional biomass, which is included in all IEA data in the report.

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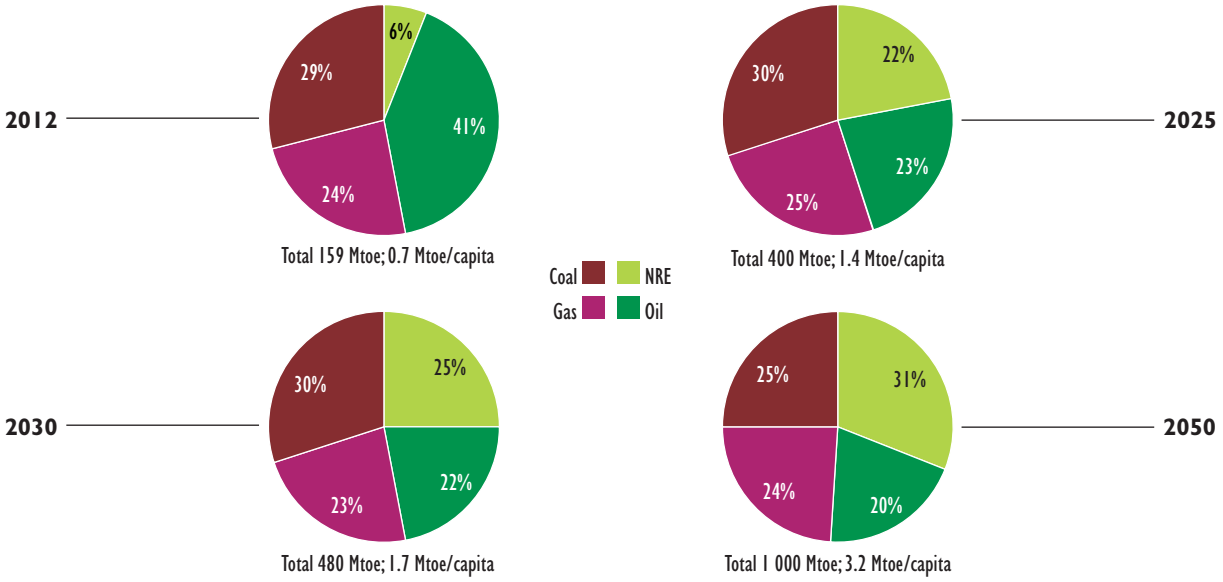
Figure 2.5 National energy mix plans to 2050



Note: NRE = new and renewable energy.

Source: NEC (National Energy Council) (2014), *National Energy Policy 2014-2025*, NEC, Jakarta.

NEP14 stipulates that exports of natural gas and coal are to be reduced gradually, and phased out eventually at a future date to be specified. This stipulation follows a similar decision for unprocessed minerals and reflects Indonesia's concern over energy security and the finiteness of its resource base.

NEP14 also introduces energy emergency policy frameworks and actions. The government aims to establish energy emergency management structures and to build up oil buffer stocks. The concern over growing import dependency is also reflected in NEP14's call to reduce energy subsidies both for fossil fuels and for electricity. Stopping short of calling for market-based pricing, NEP14 aims for an energy price that reflects "the economic equality value", which is a basic concept of Indonesia's economic development meaning that all Indonesians should have affordable access to energy.

Finally, NEP14 aims to complete the electrification of the country by 2020 and to ensure full access to energy, which is a difficult undertaking considering Indonesia's immense geographical expanse.

NATIONAL ENERGY PLANNING

The NEP's medium- and long-term goals are detailed in specific policy measures in two five-year plans, the National Energy General Plan and the National Energy General Plan (RUEN). These then become part of the general national development planning undertaken by BAPPENAS, which includes a list of infrastructure investments.

The long-term framework for Indonesia's national development goals is the Long-Term National Development Plan 2005-25. The third five-year medium-term development plan, 2015-19, was prepared in 2014. The plan will incorporate the goals of RUEN and the National Electricity General Plan.

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MASTER PLAN FOR THE ACCELERATION AND EXPANSION OF INDONESIA'S ECONOMIC DEVELOPMENT

In 2011, the government of Indonesia announced the Master Plan for the Acceleration and Expansion of Indonesia's Economic Development (MP3EI). The MP3EI rests on three main pillars: establishing six economic corridors based on the comparative advantage of the different regions of Indonesia; promoting connectivity within Indonesia and the Association of Southeast Asian Nations (ASEAN) region; and improving human resources and science and technology.

The plan outlines IDR 4 000 trillion (USD 468.5 billion) in investment over the next 14 years, including in infrastructure and energy-related projects. Government infrastructure spending to 2025 will be IDR 544 trillion (USD 63.72 billion), to be supplemented by IDR 836 trillion (USD 97.93 billion) of investment by state-owned enterprises. Regarding energy, the MP3EI focuses on the development of energy infrastructure and energy supplies, earmarking IDR 681 trillion (about USD 75.6 billion) for the power sector and energy infrastructure.

The grand vision of the MP3EI, however, has so far not been matched by actual implementation. The MP3EI document is relatively short on policy implementation and monitoring, and has not established regional or sectoral lead agencies to oversee its implementation. At least the MP3EI demonstrates that the government is fully aware of the massive investment needed in the energy sector.

THE OIL AND GAS LAW

The upstream and downstream oil and gas sectors are regulated by the 2001 Oil and Gas Law. The 2001 law is currently under revision. Adoption is expected in the first two years of the new government (2015 or 2016).

In 2010, a new regulation, GR79, amended cost recovery and tax rules in the oil and gas sector. GR79 represents the first comprehensive fiscal framework to address both upstream sectors.

MINERAL AND COAL MINING LAW

In accordance to a recommendation expressed in the previous *Energy Policy Review of Indonesia* (IEA, 2008), Indonesia issued a new Mineral and Coal Mining Law in 2009 to replace the 1967 Mining Law. The law changed the Coal Contract of Work regime (CCoW) to a licensing regime (Mining Business Licence, known as an IUP), with designated mining areas allowing 100% foreign investment, and introduced a tender process for mining areas and local content rules. It also banned raw material exports for ores, initiated a value-added policy, and authorised the government to set production quotas for every province. Most importantly, the law stipulates that each level of government can issue a mining licence dependent upon each government's authority.

ELECTRICITY LAW

Indonesia enacted a new Electricity Law in 2009, following the Constitutional Court's ruling that the 2004 Electricity Law liberalising the electricity sector violated Article 33 of the Constitution. The 2009 law, nevertheless, introduced a number of important

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changes, including a statement of overarching objectives for electricity development with regard to availability, quality and reasonableness of cost, and a substantial reduction in subsidies in the electricity sector. Most importantly, the 2009 law continued to allow independent power producers (IPPs) to generate and sell electricity to end-users and obliged PLN to purchase electricity from renewable energy producers.

CLEAN ENERGY AND GREEN GROWTH

Following Indonesia's Copenhagen pledge to voluntarily reduce GHG emissions by 26% by 2020, as against business-as-usual, or a target of 767 million tonnes of carbon dioxide equivalent ($MtCO_2$-eq), the government established the National Plan for Greenhouse Gas Reduction in 2011. It is also drafting a Master Plan for Climate Change. The energy and transport sectors are expected to contribute merely 4.9% (38 $MtCO_2$-eq) of the overall target – the lion's share of the mitigation potential resides in land use and forestry. In the energy sector, measures focus on increasing the use of biofuel, promoting engines with higher fuel efficiency standards, making improvements in transport demand management and the quality of public transport, electricity demand-side management, enhancing energy efficiency, increasing renewable energy development and post-mining remediation/reforestation.

ENVIRONMENT LAW

Under the 2009 Environmental Law, energy, mining, and palm oil companies are now required to conduct environmental risk analysis and implement environmental impact assessments for all major projects. They also need to obtain environmental permits and produce an environmental management statement and environmental management and monitoring reports regularly, depending on the industry and the project's impact on the environment. In addition, companies are required to set aside a guarantee fund to cover liabilities related to restoration of environmental damage.

ENERGY REVENUE AND RESOURCE TAXATION

Resource extraction activities are liable to specific central, regional and local government taxes, royalties and fees, and, in the case of production sharing agreements, to terms governing the sharing of production. Since 2011, all export revenues must be passed through Indonesian banks (including offshore subsidiaries). Indonesia has improved its tax system considerably over the last decade, both in respect to revenues raised and administrative efficiency. The overall tax take is still low by international comparison, which bolsters the country's attractiveness for foreign investors, but may give rise to calls for the state to increase its take.

The oil, gas and mineral sectors generate approximately 30% of government revenues (both tax and non-tax revenues). Oil production revenues are split between the government and the contractor according to an after-tax share, typically around 85/15 for mature fields and or 65/35 for marginal oil fields. Gas production sharing contracts (PSCs) usually involve a 70/30 split in revenue.

Under the 2009 Law on Minerals and Coal Mining, holders of mining licences (IUPs) pay *ad valorem* royalties, with rates varying between 2% and 7% of revenue according to the mineral produced. In addition, land taxes are levied according to the surface area mined.

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Royalties and land taxes are deductible from taxable income, which is subject to the standard 25% corporate income tax. For licences in State Reserve Zones (WPN),[3] or Special Mining Business Licences (IUPKs), an additional 10% tax is levied on net profit.

Indonesia also taxes international trade transactions. Revenue from trade taxes amount to 0.5% of GDP and stand out as very high internationally, but lower than in many countries in the region. Almost half of Indonesia's trade taxes are levied on exports. The government aims to increase its revenues from export taxes, as evidenced by the 2013 decision to levy a 20% tax on selected mineral ore exports, and the introduction of export taxes on crude palm oil. Indonesia's export taxes on commodities have been designed with several objectives in mind, including price stabilisation, fostering the development of downstream processing industries and value-added exports, and slowing the pace of depletion of non-renewable resources.

The Organisation for Economic Co-operation and Development (OECD) found that in the natural resources sector, particularly in mining, there is a case for increasing the government's share of resource rents by imposing higher tax rates on these rents, as opposed to taxing revenues (OECD, 2012). In the mining sector, a rent tax regime with a large government take would serve the country better than the export taxes and ownership restrictions that were decided on in early 2014.

ENERGY STATISTICS, FORECASTING AND MODELLING

The production of comprehensive, timely, and accurate data is the cornerstone of rational policy making. The government acknowledged this and has based its national energy policy planning on the basis of detailed data modelling and energy forecasts.

In accordance to the recommendation of the 2008 *Energy Policy Review of Indonesia* (IEA, 2008), the NEC is reviewing the possibility to develop modelling and forecasting activities to underpin long- and medium-term energy policy planning. The MEMR also has a statistical and energy modelling office, PUSDATIN, which collects and analyses energy data and provides models and forecasts to support energy policy making.

Both institutions work together with the regional energy and statistics offices to support regional energy planning on the basis of energy planning software such as LEAP and Markal, which are used to calibrate for energy planning assumptions and ensure that central-level and regional-level energy plans are based on the same assumptions.[4]

Indonesia, however, is still lacking a comprehensive set of energy data, something most visible in the coal sector. Decentralisation was completed without the establishment of a comprehensive reporting framework for data from the local and regional level up to the central level. In addition, companies do not have to report their data to central level. The coal sector is the most obvious case where the production and export data vary from institution to institution.

3. Areas where mining activities are forbidden at the moment but that might eventually be opened for state-owned companies and private investors to operate.

4. The Long-range Energy Alternatives Planning (LEAP) and The Market Allocation Model (Markal) are a data-driven, energy integrated system and an optimisation model.

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ENERGY SUBSIDIES

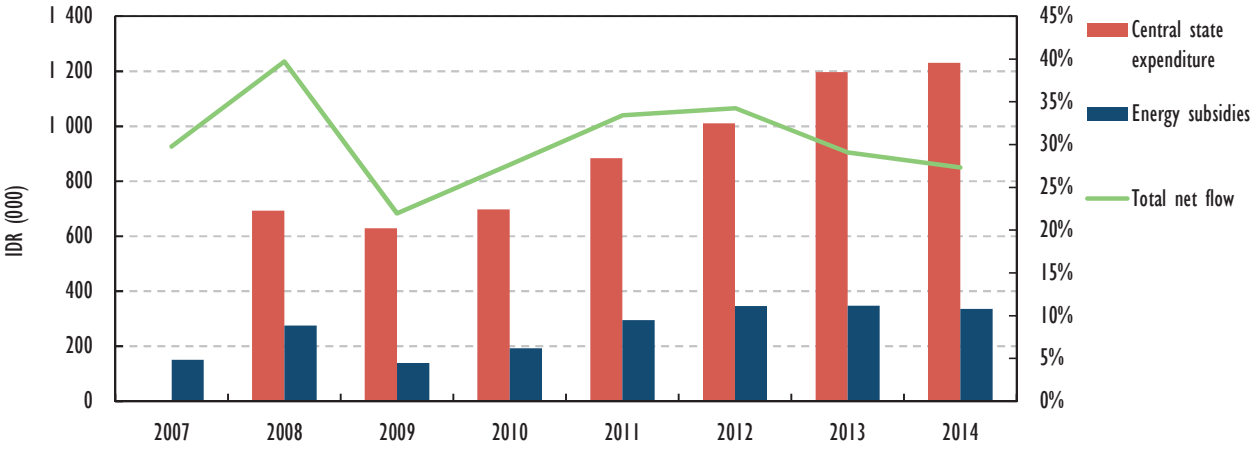
OVERVIEW

Energy subsidies are one of the most challenging facets of Indonesian politics, spanning not only energy policy, but all policy sectors. Over the past 15 years, successive governments have undertaken repeated attempts at reform, with mixed success. Today, subsidy reform is seen as an inevitable part of managing energy demand while imports continue to rise. The issue is not "whether" but "how" to implement reform (see section on "Reform" below).

Constitutional Article 33 (3) specifies that natural resources shall be used to the greatest benefit of the people. This serves as a pretext to subsidising energy at below cost prices to ensure that the Indonesian population benefits from its resources. While energy subsidies have contributed to social mobility of the population and supported widening access to energy, they have also resulted in an inefficient allocation of public resources and a market distortion effect. Fuel and electricity subsidies have become a serious burden on Indonesia's state budget by confiscating resources from much-needed investment in infrastructure, social welfare, education, etc. In addition, energy subsidies hamper energy efficiency, the development of renewable energy and ultimately of a carbon price.

Indonesia has a long history of energy subsidies dating back to the first oil price shock of the 1970s. The level of subsidy first became untenable in 1997 during the Asian financial crisis, when Indonesia had to devalue its currency, which increased the oil import bill. The country cut subsidies as part of a structural adjustment programme established by the International Monetary Fund (IMF), which led to political unrest. In the 2000s, the government attempted to reduce the continuously rising fuel subsidy bill, in particular when Indonesia went from being a net exporter to net importer of oil in 2004.

Figure 2.6 Energy subsidy expenditure



Source: IEA calculations based on data provided by the Ministry of Finance of the Republic of Indonesia (2014), *Revised State Budget 2014*, Jakarta. Bank of Indonesia; BPS (Badan Pusat Statistik/Statistics Indonesia) (2014), *Actual Government Expenditures (billion rupiahs) 2007-2014*, BPS, Jakarta.

In 2013, the government spent IDR 348 trillion (USD 27 billion) on energy subsidies, amounting to almost 11% of state budget expenditure or 2.5% of GDP. This is roughly equivalent to Indonesia's state expenditure on capital and social spending combined. For 2014, the government forecast a spend of IDR 336 trillion, a figure that is likely to be revised upwards (Figure 2.6).

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In its 2014 policy plans, the outgoing government has committed to adjusting energy pricing. The intention is to work towards a restructuring of subsidy-targeting measures (so-called "closed distribution systems") that build on the cash transfer mechanisms that were rolled out following price rises. In addition, it is considering a potential "flat-rate subsidy" that establishes a subsidy payment for individual fuels that remains constant over time despite fluctuations in international crude prices and the value of the rupiah.

FOSSIL FUELS

As a result of falling oil production and limited refining capacity, Indonesia imports about 43% of all oil products. Gasoline (47%) and diesel (47%) account for the majority of refined products sold. Indonesia currently subsidises four fossil fuel products using a fixed priced mechanism: gasoline (RON88), diesel, liquefied petroleum gas (LPG) and kerosene (Table 2.1). Sales of subsidised RON88 account for about 97% of all gasoline sold. It is important to note that the government determines the price of LPG sold in 12 kilogramme (kg) cylinders, which Pertamina is selling at a loss but does not receive reimbursement.

Table 2.1 Retail prices for subsidised fuels

Product	Official price	Subsidy (estimated)
Gasoline (RON88)	IDR 8 500	IDR 1 000
Diesel (solar)	IDR 7 500	IDR 2 000
Kerosene	IDR 2 500	IDR 6 000
LPG 3 kg	4 250/kg	IDR 6 500
LPG 12 kg	7 569/kg	IDR 3 200/kg

Source: Pertamina (2014), "Fuel sales and prices", presentation for IDR visit, March 2014, Jakarta.

Total fuel subsidies in 2014 will cover gasoline, diesel, cooking kerosene, LPG, LGV, and CNG (compressed natural gas) for public transport. The combined total volume of subsidised liquid petroleum products (gasoline, automotive diesel and kerosene) in 2014 has been set at 48 million kilolitres (kL).

Indonesia's state expenditure on subsidies is therefore highly vulnerable to oil market price and exchange rate fluctuations. Despite increasing the price in June 2013, diesel subsidies amounted to approximately 17% of total state expenditure partially as a result of heightened inflation and rising oil prices. The most recent price increase by IDR 2 000 for both gasoline and diesel combined with the significant decrease in the price of oil in October/November 2014 has brought Indonesia's fuel prices close to market prices and should result in substantial savings in the 2015 state budget.

The government has increased gasoline and diesel prices three times since the 2008 *Energy Policy Review of Indonesia* (IEA, 2008): in June 2013 by increasing prices of gasoline and diesel by 44% and 22%, respectively, and most recently in November 2014 by 30% and 36%. In addition, the government prohibited the use of subsidised fuels for government, palm oil plantation, mining industries and other vehicles, and announced its intention to implement an RFID (radio frequency identification) tagging programme to measure and control which consumers use subsidised fuel. It is also promoting a transport gas conversion programme by providing free conversion kits.

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Since 2007, the government has run a large LPG-for-kerosene conversion programme, which aims to substitute the use of subsidised kerosene with subsidised LPG in 3 kg cylinders. The programme provides a free start-up package consisting of a 3 kg LPG tank, a compact LPG stove and accessories (regulator and hose) to a maximum of 48 million households. The expected cost of the programme stands at IDR 14.11 trillion (USD 1.56 billion), while kerosene subsidy savings are estimated at IDR 33.34 trillion (USD 3.9 billion). Whereas kerosene consumption stagnated at around 12 million kL in 2013, LPG consumption increased by 22% to 4.39 million kg in 2013.

ELECTRICITY

Electricity is subsidised on the basis of differentiated rates per kilowatt hour (kWh) per customer category. These are public service institutions (class S), households (class R), businesses (class B), industry (class I) and government and street lighting (class P). Each category is subdivided into small, medium and large power connections.

Since 2008, the average electricity tariff has increased from IDR 651/kWh (USD 0.05) to IDR 745/kWh (USD 0.06) in 2012, while the average cost of electricity remains at around IDR 1 272/kWh (USD 0.10). Subsidies to large industrial consumers of electricity were abolished in 2008. In 2013, electricity tariffs were increased for all types of customers but the smallest consumers (450 volt ampere [VA] and 900 VA). The increases are adjusted quarterly up to a total capped increase of 155% year-on-year (GSI, 2014a; GSI 2014b).

In 2014, further gradual price increases were announced for medium-sized and other industries. According to the 2014 state budget, a substantial reduction in total energy subsidies is expected to come from this initiative, which in 2013 stood at IDR 100 trillion (USD 9.0 billion).

REFORM

The government recognises the need to reform subsidies for a number of reasons. First, the cost of subsidies, particularly for imported products, cannot be controlled by the government resulting in higher than planned government expenditure, which puts at risk Indonesia's legally mandated debt ceiling of 3%. Second, subsidies encourage wasteful energy consumption and run counter to the government's aim of decreasing the share of oil in the national energy mix. Third, subsidies discourage investment in energy efficiency measures and renewables, as well as electricity infrastructure. Finally, subsidies to low-grade fuel products add to air pollution and endanger human health.

Technically, Indonesia has designed and started to implement programmes that target subsidies to the poor via a differentiated tariff system, accompanied by the increase in fossil fuel prices, targeted cash transfers and fuel conversion programmes. It is also considering limiting subsidies to certain parts of the population (closed distribution).

Despite the apparent fiscal benefits of reform, increasing energy prices have negative short-term effects on Indonesia's economy in the form of heightened inflationary pressures. These, at times, threaten to erode the price increases as the rupiah's value decreases in relation to the US dollar in which oil is priced. Inflation also increases the cost of goods, affecting the general population beyond energy consumption. The Bank of Indonesia found that the 2013 energy subsidy reforms triggered "…foreign capital outflow from Indonesia…by the negative perception of foreign investors about the rising inflation pressures following the subsidised fuel price hike as well as the widening current account deficit…Inflation increased significantly as a result of the subsidised fuel price hike and rising food prices" (Bank of Indonesia, 2014).

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INFRASTRUCTURE AND LAND ACQUISITION

One of the key challenges for Indonesia is to build energy production and transport infrastructure that matches energy consumption growth. Given that Indonesia has historically underinvested in infrastructure, this is a serious challenge. If not adequately addressed, it increases the risk of widespread brown-outs and energy transport bottlenecks. It could also slow down rural electrification via grid connection.

One of the key obstacles to the development of energy and transport infrastructure is the matter of land. Land acquisition is a highly complicated matter in Indonesia, one that can take years to resolve, as land titles are often unclear and the legal and policy framework highly complex.

The territory of Indonesia is divided into forest and non-forest land, which are controlled by two different agencies: the National Land Agency (BPN) and the Ministry of Forestry. The legal framework consists of an estimated 585 legal documents relating to non-forest land affairs alone. In addition, there is a long history of informal land ownership that gives rise to any number of individuals claiming the rights to the land during any land acquisition process (World Bank, 2009).

Presidential Regulation No. 36/2005 concerning land acquisition for infrastructure development was intended to outline the rules and procedures for infrastructure projects serving public purposes; however, the regulation was ineffective because of the vagueness of its rules. In 2012, the government enacted the Land Procurement for Public Development Law, which was revised in 2014. It aimed to speed up the procurement of public land for infrastructure projects; however, it has so far failed to deliver any significant reduction in delays to land procurement for critical infrastructure projects.

ENERGY SECURITY

Indonesia's geography as an archipelago state composed of over 17 000 islands presents a significant challenge for the energy distribution system. Although 77% of electricity and over half of refined products are consumed in the Java-Bali region, consumption of energy and oil products is also growing rapidly on the other islands.

Energy security and emergency policy have become key concerns of the Indonesian government since the 2008 *Energy Policy Review of Indonesia* (IEA, 2008). The NEP14 emphasises the importance of energy independence and self-sufficiency in energy resources, and aims to enhance Indonesia's emergency policies and oil stock holdings.

EMERGENCY REVIEW ASSESSMENT

While Indonesia has no national energy security organisational structure at present, it has drafted a presidential regulation establishing a decision-making structure for energy supply disruption. It aims to establish clear responsibility for each stakeholder to ensure smooth co-ordination across relevant authorities, in close co-operation with industry.

Furthermore, Indonesia currently has no public emergency oil stocks or compulsory industry stocks, but instead relies solely upon operational stocks held by Pertamina, which amount to between 21 and 23 days of consumption. The government, however, aims to create a national energy reserve system, which would include energy buffer reserves (EBR) that can be categorised as public emergency stocks. The NEC proposed to

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hold 30 days of net imports. The country also aims to increase the level of operational stocks to 30 days of consumption. There is no legal framework for demand restraint measures, although local governments have authority to impose demand restrictions in order to control the consumption of subsidised fuels.

As an exporter of natural gas, the country has not developed any emergency measures for natural gas supply disruption at government level. However, in order to cope with local gas shortages, system operators implement emergency measures such as pushing back lost natural gas production, allocating gas supply from other gas fields to an undersupplied area, and renting fuel power generators.

The country's electricity system operator, PLN, is responsible for maintaining power system security and reliability, efficiency of transmission/distribution and quality of electricity supply. Measures include provision of emergency management resources and implementation of appropriate emergency management practices, such as over/under frequency load shedding and restoration plans. PLN has set an internal minimum operational reserve requirement at its power generation facilities of seven days of refined product stocks at dual-fuel power generators and around 25 days of coal stocks for coal-fired power generators. In the Java-Bali system, the transmission system operator provides generation reserves, such as spinning rotary reserves with a capacity of 815 megawatts (MW) per unit, and an operational reserve at Bandung pump storage with a total capacity of 1 040 MW.

ASSESSMENT

POLICY EVOLUTION

Since the 2008 *Energy Policy Review of Indonesia* (IEA, 2008), Indonesia's energy policy framework has evolved considerably. Indonesia adopted the Energy Law of 2007, which represents the first comprehensive legal framework for the energy sector, and approved the second iteration of its NEP in 2014 (i.e. NEP14). Both the law and NEP14 commit Indonesia to enhancing the sustainability of its energy sector and increasing the share of renewables and efficiency of energy production and consumption.

Indonesia is to be commended for this. The targets relating to the evolution of Indonesia's energy mix, however, appear highly ambitious compared to Indonesia's performance since the 2008 review (IEA, 2008). NEP14 could be enhanced by scrutinising the plausibility of targets against available resources and continuing bottlenecks in land acquisition and private sector investment.

In addition, there is an urgent need to co-ordinate policies and regulations and ensure their compatibility. This applies not only to divergences between central, regional and local regulations, but also among national ones. The targeted increase in coal use in the national energy mix is in direct conflict with the government's emissions reduction targets. In the mining sector, regulations and permits by central and regional governments conflict, presenting a compelling case for comprehensive legal and regulatory review before new measures are adopted. In this regard, it is time to review the Energy Law of 2007 and assess whether provisions regarding institutional responsibilities and policy frameworks could be updated.

Indonesia's energy policy is dominated by energy security concerns. The government is rightly concerned about ensuring adequate energy supply to fuel the world's sixteenth largest economy, which is growing at an average rate of 5% to 6% per year. Population

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growth is slowing to 1.1% per year, but rapid urbanisation and rising middle classes are strong demand drivers. Per capita energy consumption is projected to double by 2025. Access to electricity needs to be provided to the remaining 20% of the population who still lack it. The reliability of electricity supply needs to be further improved to attract investment into manufacturing industries.

Energy security concerns have been exacerbated since Indonesia became a net oil importer in 2004 and oil production has been dwindling fast. Concerns are also mounting in the gas sector: although a large LNG exporter, regasification terminals are being built and a first-ever long-term LNG import contract has been signed in anticipation of increasing demand. Indonesia has seen its coal exports rise in recent years to become the world's largest exporter. Although the coal industry boasts comfortable production-to-reserves ratios, considerations about capping production reflect preoccupation with long-term depletion.

Oil, gas and mining accounted for 11% of GDP and 19% of exports in 2013; however, the energy trade balance is bound to deteriorate. Gas and coal export revenues (USD 20.5 billion and USD 26.2 billion in 2012, respectively) barely offset the ballooning oil import bill (USD 40 billion). This puts pressure on the balance of payments, with the current account falling into a deficit for the first time since the Asian financial crisis of 1997.

Chronic underinvestment in energy infrastructure and the need for advanced technologies for enhanced oil recovery (EOR), unconventional gas and deepwater resources accentuate the challenge. Adding to the complexity is the geographic mismatch between energy resource locations and load centres across the archipelago.

POLICY CO-ORDINATION

Indonesia's energy policy making capacity has increased since the creation of new institutions, such as the Directorate-General for New Renewable Energy and Energy Conservation and the NEC. These should improve the modelling, planning, and co-ordination of energy policies, and promote the development of renewable energy and energy conservation.

These institutions have enhanced energy policy co-ordination and pushed the renewables and energy efficiency agenda forward. Nevertheless, too many actors and agencies continue to be involved in energy policy making with overlapping or unclear responsibilities. At times, it seems unclear which organisation or ministry is leading on the implementation and delivery of energy policy targets. Split accountabilities typically result in inaction and under- or non-delivery of targets and actions. Policy formulation and delivery could be improved by limiting and clarifying the roles and responsibilities of ministries, agencies and co-ordinating institutions.

ENERGY SUBSIDIES

The phasing out of subsidies is imperative to the development of sustainable and efficient energy production and consumption in Indonesia. The government has continued the process of reform: it increased petroleum and diesel prices three times in 2008, 2013, and 2014, and is gradually reforming electricity subsidies. These measures are consistent with the recommendations contained in the 2008 *Energy Policy Review of Indonesia* (IEA, 2008).

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However, the government needs to do more to reform subsidies. It needs to be done continuously, gradually and with a clear timescale, avoiding sudden inflationary shocks such as that in 2008. The current practice of reacting only when the subsidy bill threatens the mandated government debt ceiling of 3% is unsustainable in the long run. Key to a sustainable reform and a gradual decrease is the introduction of fluctuating prices.

The government is to be commended for having accompanied its subsidy reform with targeted programmes for the poorest. It should continue this practice but consider including not only the poorest quintile of the population but also the next lowest group, who could risk falling back into poverty if prices for daily necessities rise too quickly.

Reinvesting budget savings from fossil fuel subsidy reform into renewable energy programmes for urban households and building owners could help alleviate the impact of electricity tariff increase, and provide direct and lasting benefits to citizens. However, the government should examine the effectiveness of replacing one subsidised fuel with another closely, especially in the transport sector.

DATA QUALITY AND FORECASTING

High-quality energy data and statistics are the cornerstone of energy policy and an essential element of informed decision making. While most data produced by Indonesia are of high quality, there is room for improvement, particularly with regard to coal data.

The government needs to further improve its data collection processes and require companies and regional and local governments to report data to central government. PUSDATIN and BPS should be the only energy data collection centres.

OIL EMERGENCY RESPONSE POLICY

Indonesia is to be commended for starting to tackle energy security and emergency policy. While the government currently relies on operational oil stocks held by Pertamina, its commitment to building up strategic buffer stocks and establishing an emergency structure is to be commended strongly.

The government already has de facto restraint measures, as regions can limit the sale of subsidised fuels in times of shortage. It would be useful to implement more stringent and co-ordinated demand restraint measures that can be activated by central government.

RECOMMENDATIONS

The government of Indonesia should:

- *Resolutely decrease fossil fuel subsidies by implementing its existing phase-out timetable. Start a large-scale and long-term communication campaign on the necessity and timeline of the phase-out and the re-allocation of state expenditure, including compensatory measures for the poor as well as social development and infrastructure investment benefiting the entire population.*
- *Step up co-ordination in energy policy making and regulation, ensuring consistency between modelling scenarios, targets, and implementation. Focus on the quality of legislative and regulatory processes by clarifying competencies, enhancing*

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stakeholder consultation, defining deliverables and assigning accountability at national and sub-national levels.

- *Increase knowledge of household-level energy consumption by conducting an annual or biannual household survey of energy consumption, use and expenditure.*
- *Improve the energy investment framework by speeding up decision making, opening the energy sectors to market-based mechanisms for prices and fuel choices, and affording long-term predictability. Establish a single office to facilitate infrastructure investment in renewable energy, electricity and natural gas within the Investment Coordination Board, which would advise and support investors in obtaining the necessary permits and licences from central and local institutions.*
- *Develop and implement an integrated long-term development plan for natural gas infrastructure, reform wholesale natural gas pricing and allocation mechanisms, and establish an independent downstream regulator for natural gas and electricity, with the long-term goal of a national wholesale market and more efficient use of gas.*

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3. NATURAL GAS

Key data (2013 estimated)

Production: 78.8 bcm, +1% since 2003

Exports: 34.8 bcm, -17.8% since 2003

Share of gas (2012): 16.4% of TPES and 23.2% of electricity generation

Consumption by sector (2012): 39.2 bcm (industry 48.7%, power generation 29.5%, other transformations 21%, commercial 0.6%, residential 0.1%, transport 0.1%)

OVERVIEW

BACKGROUND

Natural gas accounts for about 16% of Indonesia's total primary energy supply (TPES) and faces growing domestic demand. The country is a mature player in the natural gas industry and has been present in the global liquefied natural gas (LNG) market since 1977. It was the world's largest LNG supplier for three decades before Qatar surpassed it in 2006. In 2012, Indonesia was the fourth-largest LNG supplier.

The country is the largest gas producer in the Southeast Asia region, and benefits from ample gas reserves, estimated at 2.9 trillion cubic metres (tcm) as of year-end 2012. Despite this, Indonesia's natural gas industry may be following the same fate as its oil industry as it moves from net exporter to net importer. Over the past few years, natural gas production has been in decline. Consequently, the country has been facing a shortage as the domestic appetite for natural gas at low prices necessitates re-routing of gas supplies intended for export to its domestic market.

SUPPLY AND DEMAND

SUPPLY

Indonesia is endowed with large natural gas resources. Although crude oil has traditionally played a greater role in Indonesia's energy supply and exports, the country's oil production has declined in recent years. By contrast, natural gas production in Indonesia has steadily increased, and in terms of calorific value, natural gas production surpassed crude oil in 2002. As such, Indonesia's energy policy has shifted its focus from the oil sector to the natural gas sector.

In 2013, Indonesia produced 78.8 billion cubic metres (bcm) of natural gas, being 2.1% higher than in 2012 but 8% lower than the peak of 85.7 bcm in 2010. The current level of production makes Indonesia the world's tenth-largest gas producer with a 2.2% share of global gas production. The country's largest production areas are in Sumatra, East Kalimantan and Papua, mostly offshore. The Mahakam Block in East Kalimantan is one of the largest and oldest gas blocks in Indonesia. Operated by Total since the 1970s, the block produced about 18 bcm or one-fifth of Indonesia's total gas output in 2013.

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One forthcoming development is the Ketapang 2 Block in East Java, which is operated by Petronas and is expected to start producing an estimated 0.77 bcm of natural gas later in 2014. Recently, companies have been paying greater attention to less-explored areas in the eastern part of the country, such as West Papua, Central Sulawesi and the Arafura Sea. Indonesia's gas production is envisaged to reach 139 bcm by 2035 (IEA, 2013).

Although the short- and long-term prospects for Indonesia's gas production are optimistic, various obstacles also exist, such as stranded and marginal gas, heavy CO_2 content in new fields (e.g. East Natuna), a lack of infrastructure to bring gas to market, and the domestic market obligation, hindering increases in gas production.

The prospects for unconventional gas production in Indonesia remain rather uncertain, although the government is actively encouraging investment in the sector, including coal-bed methane (CBM) and shale gas. Pertamina was awarded the contract for shale gas exploration in the Sumbagut Block in North Sumatra in 2013, which is estimated to possess about 525 bcm of shale gas (Jakarta Post, 2013). However, Indonesia's geographic topography and lack of infrastructure will present a considerable challenge in bringing its unconventional resources into production.

Progress has been slow in bringing CBM projects into production, despite abundant resources and government incentives aiming to bring about production of 15.4 bcm of CBM by 2023. In 2011, Pertamina signed four CBM contracts, two located in East Kalimantan and two in South Sumatra, comprising in total 14 working areas, all at the exploration stage (Pertamina, 2013).

As of 2013, four commercially producing CBM blocks were operational in Indonesia under the Sanga-Sanga CBM production sharing contract (PSC) in Kutai Basin in East Kalimantan, operated by VICO Indonesia, a joint venture between BP and ENI. CBM from this project has been exported via Bontang as LNG since March 2011, being the world's first CBM to LNG project (Thomas, 2013), although the quantities are very small.

DEMAND

The industrial sector is the main consumer of natural gas, accounting for 48.7% of domestic consumption in 2012 (the latest data available per sector). The power generation sector consumed 29.5%, while 21% was consumed in other transformations, such as in oil and gas extraction, petroleum refineries and liquefaction (LNG) or regasification plants. Less than 1% was used in the commercial, residential and transport sectors combined (Figure 3.1).

Over the ten years to 2012, overall natural gas consumption increased by 19.3%. However, this period saw a significant shift away from using gas in LNG and regasification plants, and towards greater use in power generation, transport and commercial use. Consumption by industry also increased at a slightly faster rate compared to total final consumption, as did natural gas use in households. However, residential, commercial and transport use are still relatively negligible as a share of the total.

Indonesian gas production initially oriented towards exports, but the country's declining oil production led producers to shift increasing gas volumes towards domestic consumption. In 2012, Indonesia consumed 39.2 bcm of natural gas, or just under half of its total dry gas production. Although the industrial sector accounts for the largest portion of domestic consumption, industry analysts expect the power sector to be the most significant driver of future consumption growth.

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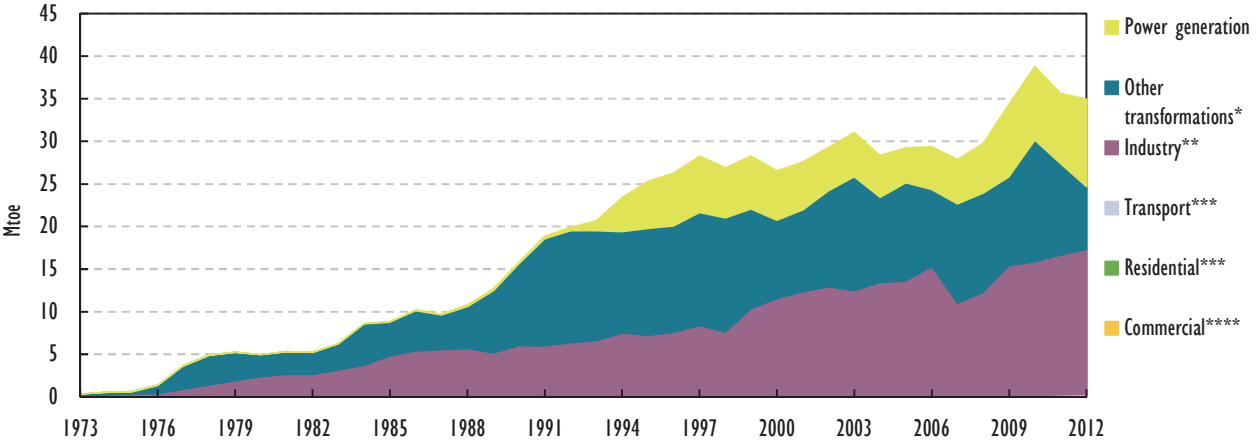
Indonesia's gas distribution utility, Perusahaan Gas Negara (PGN), currently operates more than 5 600 kilometres (km) of natural gas transmission and distribution pipelines, particularly in Java and North Sumatra. Limited pipeline distribution infrastructure is in place in East Kalimantan, South Sumatra, Jambi, Riau, South Sulawesi and West Papua. The highly fragmented nature of domestic distribution infrastructure outside Java and North Sumatra and a lack of integration of gas infrastructure across Indonesia impede a nationally integrated gas market. PGN has plans to develop gas distribution networks for small and medium-sized enterprises in the commercial and transport sectors.

PGN began operating the South Sumatra-West Java pipeline in 2008, providing an important link between the gas producing region of South Sumatra and the densely populated market of West Java. The Grissik-Duri pipeline is another important domestic transmission pipeline, as it provides gas to Chevron's Duri oil field for its steam flooding and power generation activities.

Figure 3.1 Natural gas demand by sector, 1973-2012



Notes: TPES by consuming sector; Mtoe = million tonnes of oil-equivalent.

* *Other transformations* include oil and gas extraction, petroleum refineries and liquefaction (LNG)/regasification plants.

** *Industry* includes non-energy use.

*** Negligible.

**** *Commercial* includes commercial and public services, agriculture/fishing and forestry.

Source: IEA (2014a), *Energy Data and Statistics*, OECD/IEA, Paris.

TRADE

In 2013, Indonesia exported about 34.8 bcm of natural gas, making it the world's ninth-largest gas exporter (Figure 3.2). The largest importer of Indonesian natural gas was Korea (25%), followed by Japan (21%), Singapore (20%), Malaysia (19%) and China (7%). However, the share of the country's natural gas production that is exported has been in steady decline in recent years, from 48.1 % in 2002 to 41.5% in 2013, due to increasing domestic gas demand (MEMR, 2014a). The government is strategically allocating natural gas to the domestic market to meet growing consumption primarily from the industrial and power sectors.

LNG, traditionally used for exports, is also likely to be directed towards domestic use. The government is planning to convert the Arun liquefaction plant into a regasification terminal, while the Lampung FSRU (floating storage and regasification unit) came online in 2014. Domestic LNG will arrive via the Bontang LNG terminal. According to Indonesian

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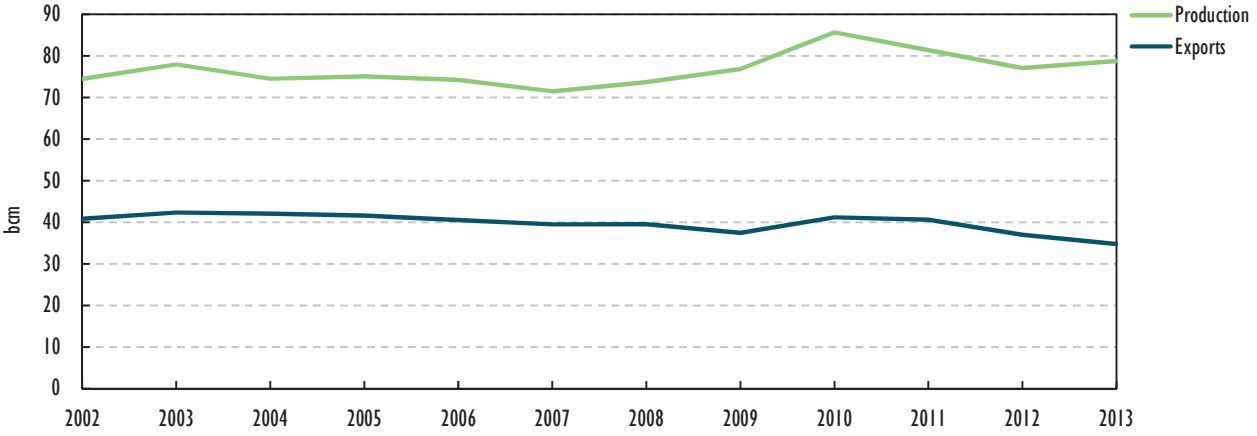
government forecasts, the country is projected to start natural gas imports from 2017 and will become a net importing country in 2022. To secure further supply, Pertamina signed a purchase agreement with US-based Cheniere Energy to receive about 1 bcm of LNG per year for 20 years, starting in 2018 (Reuters, 2013).

While the reorientation of domestic natural gas towards the Indonesian market is inevitable to meet growing demand, consideration should be given to the financial implications of such a policy. Indonesia's revenue from LNG exports amounted to nearly USD 13 billion in 2013. While down from USD 18 billion in 2011, this amount nonetheless represented almost 7% of Indonesia's total export revenue (United Nations, 2014).

Figure 3.2 Natural gas production and exports, 2002-13 (bcm)



Source: IEA (2014a), *Energy Data and Statistics 2014*, OECD/IEA, Paris.

RESERVES

Indonesia has the world's 14th-largest natural gas reserves. At the end of 2012, the country's proven natural gas reserves were estimated at 103.35 trillion standard cubic feet (tscf) or 1.5% of global natural gas reserves, while its ultimately recoverable resources are much larger at 17.7 tcm (BGR, 2013). The largest undeveloped gas reserves are located in the offshore East Natuna Block in the Riau Islands, which holds about 1.3 tcm of gas reserves. Other promising areas include West Papua and Sulawesi (Figure 3.3).

The country has also been focusing on developing its unconventional resources. Indonesia's CBM resources hold significant potential; estimated at 12.8 tcm, they are some of the largest in the world. The majority of these reserves are located in South Sumatra and Kalimantan.

Once commercial production comes online, the gas is expected to be utilised by the Bontang LNG plants or to be delivered to a compressed natural gas (CNG) plant that might be established in South Kalimantan (Jakarta Post, 2012).

The country's shale gas resources are estimated to be 16.3 tcm. The Central and South Sumatra basins are known to offer the best potential in shale gas deposits, while Kalimantan's Kutei and Tarakan basins also have potential. The Eastern Indonesian basins are small and tectonically complex (EIA, 2013).

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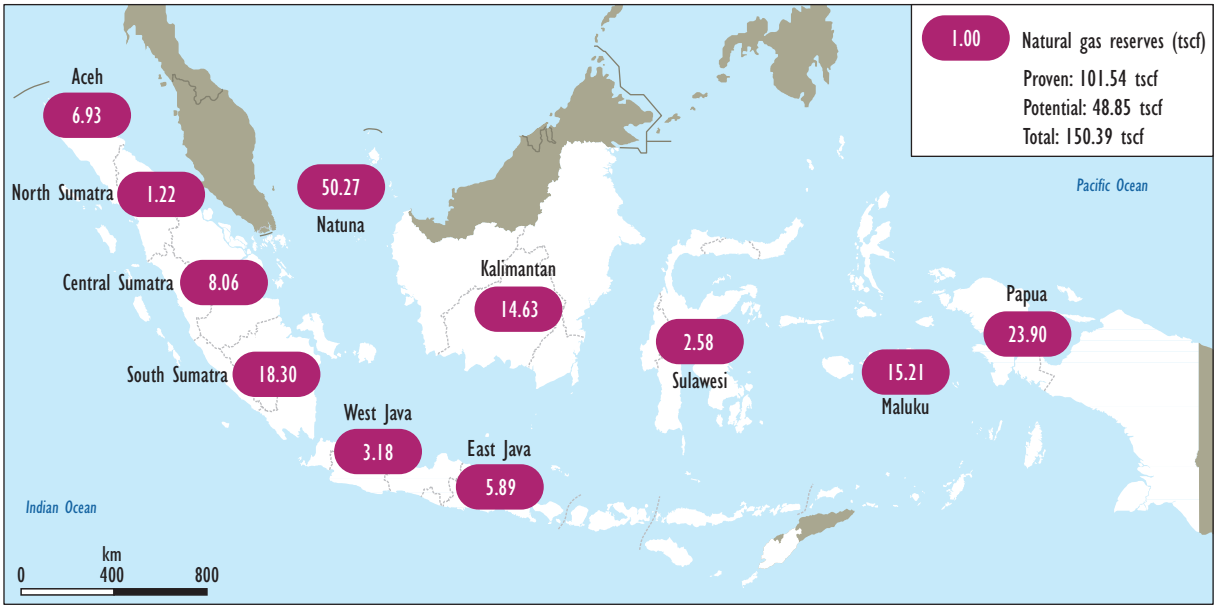
Figure 3.3 Natural gas reserves, 2012



This map is 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.

Source: Directorate-General of Oil and Gas (2013), *Natural Gas Reserves*, Ministry of Energy and Mineral Resources, Jakarta.

UNCONVENTIONAL GAS

In spite of the decline in its indigenous gas production, Indonesia has abundant unconventional gas resources in the form of shale gas and CBM; however, significant development seems unlikely in the medium term. The current regulatory framework, which is perceived as being complicated and unclear, appears to discourage industry players from investing in the sector, notably in CBM where the laws overlap with those of natural gas and coal.

The regulated domestic pricing regime and the domestic market obligation is discouraging investment in unconventional gas, particularly taking into consideration that the cost of extraction is higher than for conventional gas. Indonesia is faced with daunting tasks to develop its unconventional gas industry, from providing adequate infrastructure to implementing reforms to the regulatory framework and domestic price regime. Until all these measures are in place, it will be very difficult for unconventional gas to play a significant role in Indonesia's gas industry.

Furthermore, in July 2012 the government considered imposing a moratorium on the signing of new contracts for natural gas exports, as part of a series of initiatives to meet the increasing levels of domestic demand anticipated by the Ministry of Energy and Mineral Resources (MEMR). However, the ministry ruled out the move later in the same month. A similar moratorium first occurred in 2005 and resurfaced several times in subsequent years, notably in 2009, initially prohibiting Donggi-Senoro LNG from exporting gas. The project eventually obtained the government's approval in 2010 when it agreed to set aside 30% of volumes for domestic consumption. Despite numerous attempts to ban the country's gas exports, such a ban seems unlikely to happen in the foreseeable future, given the considerable revenue that the government receives from the export sector and the large gap between international and current domestic market prices (IEA, 2014b).

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INSTITUTIONS AND REGULATION

Indonesia's energy sector is governed by the National Energy Policy and a number of sectoral laws and regulations. The regulatory structure of the gas sector is broadly similar to that of the oil sector. The most important regulations are the 2001 Law on the Oil and Gas Sector, which is being revised at present, the 2009 Law on Mining and Coal and the 2009 Law on Electricity.

The **Ministry of Energy and Mineral Resources** (MEMR) is responsible for both oil and natural gas. It consists of four directorates general, one of which (DG Oil and Gas) oversees the gas sector. In addition, two central ministries, the Ministry of Finance and the Ministry of National Development Planning, known as BAPPENAS, and five line ministries (Economic Affairs, Transport, Environment, Industry, Research and Technology) have a role in formulating energy policies and investments covering the gas sector.

In 2008, Indonesia established the **National Energy Council** (NEC) to serve as co-ordinator for the design and formulation of energy policy, to decide measures to manage energy crises and emergencies, and to monitor the implementation of cross-sectoral energy policy. The NEC is chaired by the President and the Vice President, while the Minister for Energy and Mineral Resources serves as Executive Chairperson. The NEC also includes other important representatives, namely a prominent scholar, an industrial representative, an environmental representative, a technological representative and a consumer representative.

The House of Representatives (DPR) and regional governments: Commission VII of the House of Representatives is responsible for energy, mineral resources, research and technology, and environmental matters. This responsibility includes oversight of all oil and gas activities. It drafts oil- and gas-related legislation, controls elements of state budgets and parts of related government policy. The Commission provides suggestions to government in relation to the oil and gas sector's contributions to the state budget.

Regional governments are involved in the process leading to the approval of plans of development or field development plans by means of approval of local permits and land rights.

UPSTREAM REGULATIONS

As in the oil sector, the upstream gas sector falls under the responsibility of MEMR for general policy formulation and implementation. The sector was previously regulated[1] by BP Migas, but is now regulated by its replacement, SKK Migas.

The upstream gas sector is also governed by production sharing contracts (PSCs), similar to the oil sector. Under the terms of a PSC, natural gas producers are required to fulfil their DMO, by supplying 25% of produced gas to the domestic market. Other conditions are the same as for oil PSCs, with the exception of the after-tax split between the government and the contractor, which is 70:30 in the case of natural gas compared to 85:15 for oil after tax.

SKK Migas is the upstream oil and gas regulator. It replaced the previously independent regulatory body, BP Migas, which was dissolved when the Constitutional Court deemed that the role and responsibility of BP Migas violated Article 33 of the Constitution, which

1. This refers to the control of the operational management of upstream contracts.

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states that Indonesia's natural resources are state-owned and therefore should be controlled by the government. The ruling also stipulated that regulatory powers held by the agency were to be returned to the government until a new regulation was issued. SKK Migas assumed responsibility for signing, managing and monitoring PSCs with both domestic and foreign companies. However, controversy surrounds the legal legitimacy and responsibility of SKK Migas, as it was created as a temporary task force.

DOWNSTREAM REGULATIONS

BPH Migas is the principal downstream regulator for both the oil and gas industries. In the downstream natural gas sector it regulates, develops and supervises the downstream industry and retail fuel distribution and supply.

BPH Migas was established in December 2002 to assume Pertamina's regulatory roles in relation to downstream activities, in accordance with Articles 46 and 47 of Law No. 22 sanctioned in 2001. It is responsible for ensuring sufficient natural gas and domestic fuel supplies and the safe operation of refining, storage, transport and distribution of gas and petroleum products via business licences. It is also responsible for the supervision of the transport of gas through pipelines.

Companies active in the downstream sector are required to operate through an Indonesian-incorporated entity, known as a PT Company, and to have acquired a business licence (issued by MEMR, with input from BPH Migas).

BPH Migas has the authority to:

- regulate, designate, and supervise tariffs after considering the economic considerations of the PT Company, users and consumers
- grant permits for the transport of gas by pipelines to a PT Company based on the Master Plan for a National Gas Transmission and Distribution Network.

A PT Company may increase the capacity of its facilities and means of transport after obtaining special permission. BPH Migas is managed by one chairman and eight members; the chairman and members of the regulatory body are responsible to the President, who appoints them after consultation with the parliament. The downstream natural gas sector in Indonesia is dominated by two state-owned companies, PGN and Pertagas, a subsidiary of Pertamina. **PT Perusahaan Gas Negara (PGN)** supports the government's economic and national development programmes in the use of natural gas for the benefit of the public as well as the supply for public consumption. To satisfy these objectives, PGN constructs transmission pipelines in accordance with policies determined by government. The government maintains a 57% share of ownership while public investors control the remaining 43%. In addition, the government owns one series-A *Dwiwarna* share, which has special voting rights. Ownership of the *Dwiwarna* share, which is vested in the Ministry of Finance, gives the government special voting and veto rights. Accordingly, and under the authority of the Ministry of Finance, the Minister of State-Owned Enterprise may exercise the rights vested in these securities as "controlling shareholder".

The *Dwiwarna* share has the same rights and restrictions as ordinary shares with the exception that it cannot be transferred. It also has special rights assigned to it regarding changes in capitalisation, the appointment and termination of members of the board of directors and other corporate matters.

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PT Pertamina, the state-owned oil and gas company, is the sole owner of PT Pertamina Gas (Pertagas), which was established in February 2007. Its establishment was to fulfil the requirements of Law No. 22/2001 and the increase in demand for gas in Indonesia as an environmentally friendly alternative to fuel oil. In the natural gas market, it operates the Arun and Bontang LNG facilities as well as gas trading, transport and processing, and other businesses related to natural gas.

GOVERNMENT POLICIES

A complex set of laws and regulations governs the operation of the natural gas sector. Principal among these are the Constitution and Law No. 22/2001. This latter law formally liberalised the downstream market by opening the sector (processing, transport, storage and trading) to direct foreign investment and ending the former monopoly of Pertamina. The upstream and downstream oil and gas sectors in Indonesia are regulated by the 2001 Oil and Gas Law, which is currently under revision. This is expected to be concluded in the first two years of the new 2014 government. In January 2014, parliament adopted a new National Energy Policy (NEP14), which is expected to be transposed as a Presidential Decree in mid-2014. Notably, NEP14 calls for the reduction and eventual phase-out of fossil fuel exports from Indonesia and their redirection to the domestic market. This has already resulted in the cancellation of a gas export contract with Singapore. The NEP14 projects that the share of natural gas in primary energy supply will remain relatively flat between 2012 and 2050 at 24%, albeit at much higher volumes as energy supply increases.

Indonesia's constitution sets out the principles upon which national energy policy and the management of the nations' energy resources need to be based. Article 33 (parts 2 and 3) states that "production sectors that are vital to the state and that affect the livelihood of a considerable part of the population are to be controlled by the state" and that "the land and the waters as well as the natural riches therein are to be controlled by the state to be exploited to the greatest benefit of the people". This article has been invoked to prevent changes to implement a more market and foreign investment-friendly structure in the energy sector. This partly explains why Indonesia struggles to attract sufficient investment to meet growing domestic energy consumption, together with inadequate infrastructure and a complex regulatory environment. Article 33 has prevented the establishment of independent regulators, the liberalisation of Indonesia's energy markets, the unbundling and privatisation of state-owned companies involved in energy production, and the phase-out of energy subsidies.

In 2010, Indonesia introduced a new regulation, GR 79, amending the rules and regulations for cost recovery and income tax in the oil and gas sectors. GR79 represents the first comprehensive framework for these issues in the upstream and downstream sectors.

Indonesia's natural gas upstream arrangements (in the form of PSCs) make producers responsible for meeting domestic natural gas demand. Government regulation GR 35 of 2004 (replaced by GR 55 of 2009), in respect of PSCs executed after 23 November 2001, established the producer's DMO at 25% of its share of production (although this share is understood to be higher at times). In 2010, the government introduced a priority allocation mechanism for the use of DMO gas, by means of GR 3 of 2010. Accordingly, gas use is prioritised in the following order: oil and gas production, the fertiliser industry, the power sector, and lastly, other industrial sectors. This volume is in turn allocated among each sector at prices negotiated between the suppler and consumer. These

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prices are approved by MEMR and at present vary among sectors. They are estimated by the World Bank to average USD 6.95 per million British thermal units (MBtu), well below the export price and market prices throughout the region. It is forecast that Indonesia may have to import LNG at market prices in order to serve its domestic market.

INDUSTRY STRUCTURE

UPSTREAM

Multiple companies, both international and domestic, participate in the upstream natural gas sector in Indonesia. The top ten companies account for nearly 85% of total gas production, and in 2012 the largest producer was Total producing 20.8% of Indonesia's gas, followed by BP (15%), Pertamina (12.9%) and ConocoPhillips Grissik (12.6%). Total had 16 PSCs as at the end of 2012, of which six were under the company's operation. Most of its production comes from the Mahakam area. Several Chinese national oil companies, including PetroChina, are also active in the sector.

LNG

Indonesia has three operating LNG liquefaction plants, Bontang, Arun and Tangguh, with a combined capacity of 46 bcm per year. The country has plans to construct three additional liquefaction plants: two at Donggi-Senoro and Sengkang in Sulawesi and one in Masela. Furthermore, there is a plan to expand the Tangguh plant together with the Abadi floating LNG (FLNG) project in the remote Arafura Sea. Those projects will boost the country's combined liquefaction capacity to over 60 bcm per year.

Table 3.1 LNG infrastructure in Indonesia

Terminal name	Shareholders	Location	Receiving capacity	Start date	LNG source	Customers
Regas Satu FSRU (West Java)	Nusantara Regas (Pertamina 60%, PGN 40%)	Jakarta Bay	3 Mtpa	May 2012	Bontang and imports	PLN (Tanjung Priok and the Muara Karang power plants) and Pupuk Kujang
Lampung FSRU (South Sumatra)	PGN	Labuhan Maringgai	2-3 Mtpa	2014	Domestic and imports	PLN and local industries
East Central Java FSRU	Pertamina	Semarang (possible)	3 Mtpa	post-2014	Bontang and imports (short term); Abadi (long term)	PLN and local industries
Arun LNG Facility	Pertamina	Aceh	3 Mtpa	post-2015	Tangguh and imports	PLN (Belawan power plant) and local industries in Aceh and North Sumatra

Note: Mtpa = million tonnes per annum.

Source: Fesharaki, F. (2012), "Indonesian LNG in the global context", presentation to the FACTS Global Energy (FGE) Indonesia LNG Forum, 12-13 July.

Rapidly rising demand and limited interconnections between countries in Southeast Asia have prompted the installation of several LNG regasification terminals in recent years. Indonesia's first regasification terminal, an FSRU with a capacity of 4.1 bcm in West Java, started receiving deliveries in 2012 with 1.4 bcm of LNG from the domestic Bontang LNG plant. A part of the Arun liquefaction plant has been subject to modification for conversion to regasification. The country also plans to construct three FSRU facilities

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with a combined capacity of 10 bcm. They are planned to be located in Lampung, Banten and Central Java, all close to the country's largest demand centres on Java. If all planned development is completed, the country will have a total regasification capacity of around 18 bcm. These FSRU facilities would contribute to enhancing security of natural gas supply by providing alternative resources, more flexibility and adequate storage to shave peak demand (see Table 3.1 above).

TRANSMISSION

The Indonesian natural gas pipeline network is comprised of a number of fragmented point-to-point grid systems, which transport gas between supply sources and large consumers or demand centres. Most pipeline networks are unconnected, as the country is composed of more than 17 000 islands and natural gas production is located on several islands. Transmission or distribution of gas by pipeline requires approval from the downstream regulator, BPH Migas, which grants licences only for specific pipelines in commercial regions.

Transmission pipelines are considered by government to be a natural monopoly, and Law 22 imposes the requirement for open access. Otherwise, no requirement is placed on operators of pipelines and storage facilities to expand their projects to accommodate third-party access.

Indonesia has three large gas transmission system operators (TSOs), two of which, PGN and Pertagas, are state-owned. A third, Transportasi Gas Indonesia (TGI), which is owned 60% by PGN and 40% by a consortium of ConocoPhillips, Petronas, Talisman Energy and Singapore Petroleum, owns and operates two transmission pipelines. Pertagas operates 42% of the country's transmission system network, followed by PGN (28%) and TGI (27%).

Pertagas owns and operates approximately 1 600 km of pipeline network across South Sumatra, West Java, Banten, East Java, North Aceh, North Sumatra and East Kalimantan (Figure 3.4). PGN operates the high-pressure pipeline network in South Sumatra, North Sumatra and West Java. The PGN system is approximately 2 300 km in length and transports natural gas from the producing regions to consumers. PGN receives a toll fee for the transport of the gas as specified in gas transport agreements (GTAs) operable over 10 to 20 years. However, the limited size of the network and the lack of interconnectivity have been obstacles to further domestic consumption. Given their common ownership, a merger between Pertagas and PGN has long been mooted, but was ruled out by government in May 2014. Rather than merge as a single entity, the companies agreed to co-operate to develop gas distribution facilities in the country.

TGI operates the only cross-border natural gas pipeline, from the Natuna Islands of Riau and South Sumatra across the Strait of Malacca to Singapore. In 2012, Indonesia exported 7.7 bcm of natural gas via TGI pipelines to Singapore.

The transmission system is complex owing to factors such as the lack of pipeline system operations integration, including with electricity system operators, and unsynchronised regulations between the different upstream and downstream regulators. Direct co-ordination of transmission regulations between regulators is limited as each authority operates a different policy for network charges. For example, self-consumption of natural gas production activities is granted precedence according to the priority allocation mechanism under the DMO for gas.

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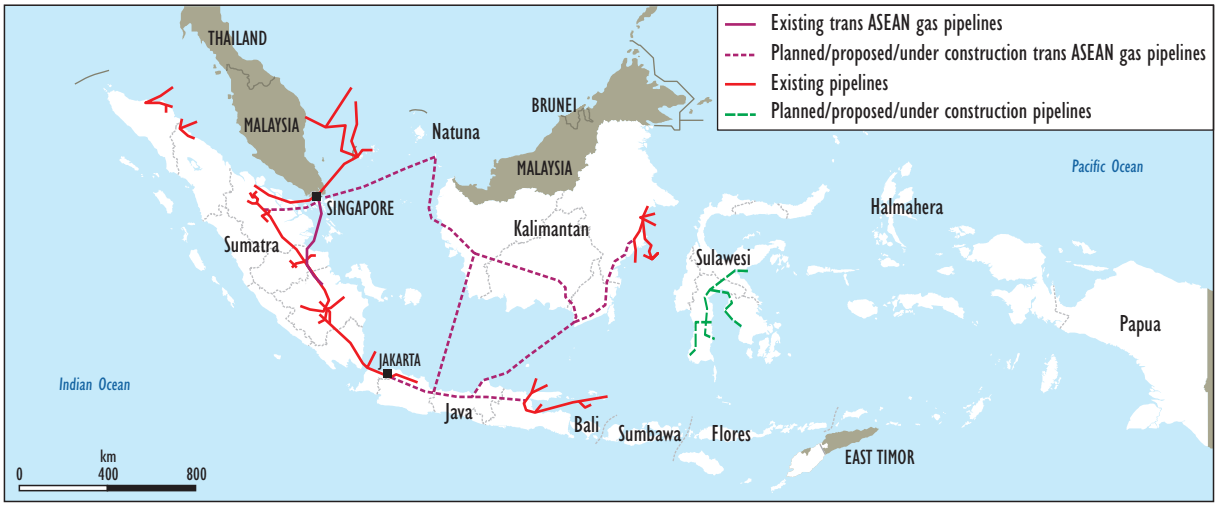
Figure 3.4 Natural gas transmission network



This map is 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.

Source: Directorate-General of Oil and Gas (2012), *Master Plan of Transmission and Distribution National Gas Network 2012-2025*, MEMR, Jakarta.

DISTRIBUTION AND RETAIL

PGN dominates the natural gas distribution network. It operates a natural gas pipeline distribution network of more than 3 700 km, supplying natural gas to power plants, industry, the commercial sector and households. Nonetheless, the distribution of natural gas is fully open with 19 distribution system operators in the Java and Sumatra regions.

EMERGENCY PREPAREDNESS

As an exporter of natural gas, Indonesia has not developed any emergency measures in case of natural gas supply crisis at national government level. Nonetheless the country plans to follow the same decision-making process in case of natural gas disruption as in oil disruption (see the section entitled "Emergency Response Policy" in Chapter 4).

In the case of a local gas supply shortage, system operators can implement emergency measures allocating gas supply from other gas fields to undersupplied areas and renting portable generating capacity. Indonesia has also started to enhance its gas infrastructure by investing in FSRUs. These facilities will allow the country to receive natural gas supplies from alternative sources, as well as improve peak shaving capacity.

EMERGENCY RESPONSE MEASURES

Indonesia's emergency response measures focus on demand-side mechanisms. In the event of a natural gas supply shortage, the following measures will generally be implemented by industry:

- optimisation of coal power plants
- if this is insufficient, use of alternative fuels in dual-fuel power plants
- utilisation of hydropower plant (pump storage)
- consumer load management.

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In the power sector, some fuel-switching capacity exists in dual-fuel power plants, but there is no regulation or policy to promote fuel switching from natural gas to other fuels. PLN, the electricity transmission system operator, maintains 35 gas-fired dual-fuel power plants with a total combined capacity of 11 596 megawatts (equal to 6% of total electricity consumption in 2013), which can replace 7.4 bcm of natural gas demand. Dual-fuel gas generators tend to keep a minimum fuel stock equivalent to seven days of supply.

In the largest demand centre of the country, Java, PGN plans to use line pack from South Sumatra and West Java (SSWJ) pipelines to cover peak demand. If this is inadequate, the company prioritises supply to customers in the following order:

- interruptible contracts with power generators which have alternative fuels
- interruptible contracts with industry which have alternative fuels
- industry without alternative fuels
- households.

According to PGN, interruptible contracts represent 20% to 25% of total consumption in the region. While there is another transmission system operator in West Java, neither mutual co-operation nor reverse flow capacity is in place in case of supply shortages.

NATURAL GAS PRICES

Natural gas prices in Indonesia are low compared to international prices and largely determined by government policy decisions rather than the market.[2] The original purpose of government pricing regulation was to provide strong incentives for industry and commercial customers to consume natural gas rather than oil. In 2013, PGN sold natural gas to the domestic market at an average price of USD 6.95/MBtu compared to export prices of USD 10/MBtu for pipeline exports and USD 16/MBtu for LNG exports (Table 3.2) (PDC, 2014).

Table 3.2 Natural gas prices in Indonesia

Category	Price (USD per MBtu)
Fertiliser industry	4.00 to 9.39
Power generation	4.55 to 14.00
Industrial sector	4.08 to 9.02
Gas trader	4.20 to 7.90
LNG export prices	8.12 to 16.31

Source: Directorate-General of Oil and Gas (2014), presentation on natural gas prices, MEMR, Jakarta.

Low domestic gas prices do not encourage either energy efficiency on the demand side or exploration and production (E&P) activities on the supply side. Low prices also result in heavy burdens on the state budget when gas has to be imported before being resold at lower prices (IEA, 2014b). The three main Asian gas users facing these problems

2. Government Regulation 36 of 2004, Chapter XII, Prices of Oil Fuel and Gas.

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– India, Indonesia and Malaysia – have developed different strategies in response. In the case of Indonesia, where demand is mainly concentrated in Java, and the available supply comes mainly from Kalimantan and Sumatra, LNG import terminals are needed near consuming centres.

One impact of regulated natural gas prices is that the country faces shortages, since domestic appetite for natural gas at low prices requires the re-routing of gas supply intended for LNG exports to its domestic market. Indonesia is currently re-routing its LNG to its existing regasification terminal, the 3 million tonnes per year Nusantara, and as discussed above, is increasing its regasification capacity. Future LNG supplies will come from domestic LNG (Bontang) as well as from imports.

ASSESSMENT

The decline in Indonesia's natural gas production continued in 2013, as the country managed to produce 70 bcm, 9% less than production in 2012. Exploration activities have not been successful; only a few discoveries were reported in 2013, notably in Sumatra, where new gas was discovered in the Block A PSC and the Jabung Block. The downward trend is expected to continue; Pertamina announced that it would produce 17% less LNG in 2014 than in 2013.

DOWNSTREAM SECTOR

Regulatory oversight

At present, a number of institutions are involved in natural gas policy co-ordination and implementation. The long-term development of the sector has been impeded by the lack of co-ordination and competing priorities among these many bodies. Furthermore, since the last *Energy Policy Review of Indonesia* (IEA, 2008) the sector regulator for downstream activities in the natural gas and oil industries, BPH Migas, has been absorbed into MEMR. The role of regulator for downstream natural gas pipelines activities has been delegated to BPH Migas, which has responsibility to determine toll fees for transmission gas pipelines, to set the sales price of gas for households and small customers, and to monitor policy implementation.

To ensure that policy decisions in the natural gas sector are taken in a co-ordinated manner, consistent with broader energy policy and the development of the economy, responsibility for the sector should be concentrated in fewer institutions complemented by the establishment of an industry co-ordination group, which should include representation from all industry stakeholders.

Gas allocation and pricing

Low natural gas prices are a cornerstone of Indonesian energy policy and have supported the shift in many industries from more expensive fuels, notably oil, to natural gas as a primary energy source. It is forecasted that Indonesia may have to import LNG at market prices (and sell at a loss at domestic prices) to satisfy its domestic market.

The combination of mandatory allocation of gas supply and regulated prices are significant drivers of inefficiencies in the economy and likely to result in higher long-term costs. While recognising that a move to a market mechanism is unrealistic in the short term, Indonesia needs to reform the allocation mechanism and introduce a transparent

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and predictable natural gas pricing regime, one which brings domestic prices closer to export levels. This would facilitate the long-term transition to a natural gas market and enhance the country's ability to attract significant upstream investment. This, in turn, should facilitate the more efficient distribution of natural gas supply among the key sectors of the domestic economy. Pricing reform must also be complemented with changes to the DMO and the wholesale market for electricity.

Gas transmission

While many stakeholders participate in the downstream sector, state-owned PGN owns and operates almost all natural gas transmission and distribution pipelines. Operation of the transmission system is complex owing to a number of factors, such as the lack of pipeline integration and the distances between supply and demand. The transmission network is not an integrated system and it is planned and operated in isolation from the overall needs of the economy and the upstream sector. The principal planning document is the National Gas Transmission and Distribution Master Plan, prepared by government, which covers the period between 2012 and 2025, and contains an inventory of planned transmission and distribution pipeline infrastructure.

The sector suffers from multiple problems, notably: the lack of integrated long-term planning; the extensive lead times for infrastructure planning, construction and commission; the lack of co-ordination between the market sectors, including the power sector; and physical constraints and bottlenecks. Integrated long-term planning is a feature of most gas markets elsewhere, and many successful models exist upon which Indonesia could base its own model. New planning mechanisms should, however, be implemented consistently within an appropriate timeframe designed by the Indonesian government.

Over the longer term, the transmission network needs to evolve to facilitate the emergence of a transparent domestic wholesale gas market. Responsibility for oversight and co-ordination of the gas transport sector should be placed with one agency, the independent regulator, which should be tasked with, among other things, the long-term development of the sector as well as responsibility for the implementation of a transparent transmission access and pricing regime.

Natural gas and the power sector

In 2012, natural gas provided approximately 23% of Indonesia's power supply, and the sector is expected to be the main driver of growth in natural gas consumption over the coming decades. In 2013, natural gas provided approximately 22.5% of Indonesia's power supply, and the sector is expected to be the main driver of growth in natural gas consumption over the coming decades. According to MEMR, approximately 60 gigawatts of new power capacity will be added to the electricity system over the next eight years. Emissions from the sector are expected to more than double between 2011 and 2020, with coal accounting for 90% of all emissions. While the government expects much of the new build to be based on clean coal technology, there is a need for greater volumes of new gas-fired generating plant.

Newly built combined-cycle gas turbine (CCGT) power generation is among the cleanest and most efficient methods of fossil fuel power generation. Furthermore, CCGT plants can be built relatively quickly and can be utilised to increase system flexibility and stability. Much of the existing capacity is operated as base load, owing to the existence

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of take-or-pay contracts and the absence of opportunity to trade gas. The long-term potential of natural gas as a power source is limited by a number of factors, such as the availability of cheap coal and lack of access to transmission infrastructure and gas supply. Plans for the expansion of electricity capacity must be developed in parallel with new natural gas infrastructure and upstream developments.

RECOMMENDATIONS

The government of Indonesia should:

- *Reduce the level of bureaucracy and the number of ministries and agencies with responsibility for the downstream gas sector. An independent regulator and gas market co-ordination group should be established by combining existing bodies. The government should also ensure that any new entities have sufficient human capacity and financial resources to do their job.*
- *Develop a transparent roadmap, with clear milestones and targets, to support reform of wholesale natural gas pricing and allocation mechanisms, with the long-term goal of moving the market towards LNG export prices. Pricing reform should also support the development of a national wholesale market and more efficient use of gas.*
- *Develop and implement a long-term integrated development plan for natural gas infrastructure. This plan should be the responsibility of one agency and be subject to a transparent public consultation process, and consider the needs of stakeholders including the public, upstream developers and the power sector.*

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4. OIL

Key data (2012)

Crude oil production: 42.6 Mtoe, -30.6% since 2002

Crude oil net imports: 1.9 Mtoe

Oil products net exports: 28.6 Mtoe

Share of oil: 36.1% of TPES and 16.7% of electricity generation

Consumption: 77.2 Mtoe (transport 50.9%, residential 15.1%, industry 14.4%, power generation 10.7%, commercial and other services 8.8%)

OVERVIEW

BACKGROUND

Oil is Indonesia's primary source of energy, accounting for about 36% of country's total primary energy supply (TPES). The country is a mature player in the global oil industry, with a long history of oil exploration and production. However, the oil sector in Indonesia has experienced considerable change in recent decades. The country's reserves and production have declined continuously since its production peak in the mid-1990s, which led to the country becoming a net oil importer in 2004. Meanwhile, Indonesia's demand for oil increased significantly in recent years, bolstered by its strong national economic growth. Indonesia is now faced with increasing dependency on imported crude oil and oil products, which places enormous pressure on its government budget, as the government subsidises a number of oil products at prices lower than international levels. As oil reserves are shrinking, the government of Indonesia is now shifting its policy focus away from the oil sector and emphasising development of its considerable gas resources. The country aims to reduce the share of oil in its future energy mix by encouraging the use of other fuels, especially in the transport and power sectors. Yet oil will remain important for national energy supply as well as government revenue. The country still needs to resolve multiple challenges in the oil sector along its entire value chain, to ensure optimal, sustainable development and utilisation of its oil resources.

SUPPLY AND DEMAND

SUPPLY

Production of oil in Indonesia started in 1885 after its first discovery in Sumatra. Today, the bulk of Indonesia's oil production sites are located in Central Sumatra, Java and Kalimantan, both on and offshore, while Indonesia's two oldest and largest-producing fields, Duri and Minas, are located on the eastern coast of Sumatra. Indonesian crude oil is typically a light sweet grade.

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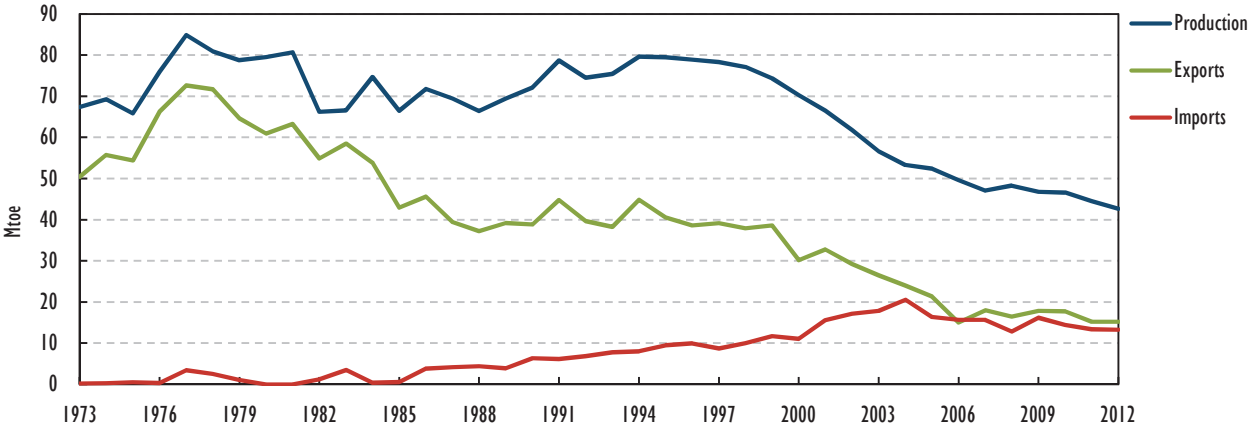
Indonesia's domestic production was 0.9 million barrels per day (mb/d) in 2012, a figure which has been declining since peak production of 1.67 mb/d in 1994. In the medium and long term, its domestic production is expected to decrease further to 0.75 mb/d in 2018 and 0.67 mb/d in 2035. As such, the prospects for new project development are limited. The Cepu Block, which is located in East and Central Java and contains 600 million barrels (mb) of recoverable liquids, is the only major new development at the moment. ExxonMobil operates the block with a 45% interest, along with Pertamina (45%) and the local government (10%). The Banyu Urip project is the first development in the Cepu Block, and is expected to ramp up to more than 150 thousand barrels per day (kb/d) in 2014/15, following delays. These projects will help mitigate Indonesia's medium-term rate of decline in average production, but not the long-term trend.

The government of Indonesia aims to increase domestic oil production through the use of enhanced oil recovery (EOR) and new investments in deep offshore waters. Presidential Instruction No. 2 of 2012 set an oil production target of 1.01 mb/d by 2014 and instructed the relevant government bodies to take necessary actions to achieve it. This has not, however, resulted in an increase in domestic production. Recently, the government lowered its production target to between 830 kb/d and 870 kb/d for 2015, a decline from the original 2015 target which was between 900 kb/d and 920 kb/d (Jakarta Post, 2014).

Figure 4.1 Crude oil production, imports and exports, 1973-2012



Notes: Mtoe = million tonnes of oil-equivalent.

Source: IEA (2014a), *Oil Information*, OECD/IEA, Paris.

DEMAND

Indonesia's oil demand reached 1.62 mb/d in 2012, an increase of over 35% from 1.19 mb/d in 2002. The main source of increased demand has been the transport sector, which accounted for 56% of oil used in Indonesia in 2012, in comparison to 40% in 2002; this represents an annual average growth rate of over 6%. The trend of increasing oil demand from Indonesia's transport sector is expected to continue in the coming years, considering that the country's rate of passenger car ownership stood at 39 per 1 000 capita in 2011, compared to the world average of 123 per 1 000 capita, and an average of 447 per 1 000 capita in Organisation for Economic Co-operation and Development (OECD) member countries. The power sector is another major oil consumer, accounting for 12% of oil consumption in 2012. Oil, mostly in the form of diesel, was used to produce 17% of generated electricity in 2012. Although this share has decreased from

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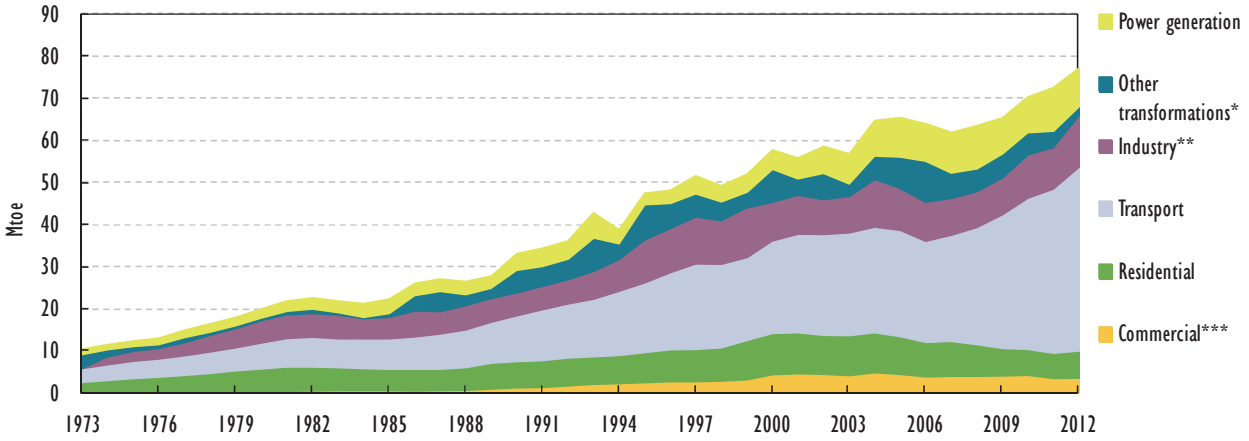
nearly one-quarter of generated electricity in 2002, oil remains the third-largest source of power generation following coal and natural gas. Looking ahead, Indonesia's total oil demand is projected to grow at an average annual rate of 1.1%, reaching 2.1 mb/d in 2035.

Figure 4.2 TPES of oil by consuming sector, 1973-2012



** Other transformations* include refining and energy sector consumption.

*** Industry* includes non-energy use.

**** Commercial* includes commercial, public services, agriculture/forestry, fishing and other final consumption.

Source: IEA (2014b), *Energy Balances of Non-OECD Countries 2014*, OECD/IEA, Paris.

TRADE

Indonesia has been a net importer of oil since 2004. The country, which represented 5% of global crude oil exports in 1983, suspended its membership in the Organization of the Petroleum Exporting Countries (OPEC) in 2009. Indonesia's share of global crude exports has since decreased to less than 1%. Meanwhile, the country's oil import dependency reached nearly one-third of its domestic demand in 2012, and this is expected to rise to 40% in 2018. Indonesia mostly imports crude oil from Nigeria, Saudi Arabia, Iraq and Azerbaijan. Although it is a net importer, Indonesia also exported 275 kb/d of crude and natural gas liquids to Asia-Pacific countries, including Japan, in 2012.

Due to a shortage of domestic refining capacity, Indonesia imports a considerable amount of petroleum products from overseas, including Korea, Singapore, Malaysia and Kuwait, leading to an import dependency rate for petroleum products of 35%. In 2013, the largest imports were premium gasoline (57% in volume terms) mostly imported from Singapore, followed by diesel (21%) and liquefied petroleum gas (LPG) (17%) (JODI Oil, 2014). In particular, Indonesia shows greater dependency on imports of light distillate products: it imported nearly 60% of its gasoline demand and 45% of its LPG demand in 2012.

RESERVES

Indonesia faces the challenges associated with declining domestic crude oil reserves. At the end of 2012, the country's proven oil reserves were 2.7 billion barrels (bbl), with remaining recoverable resources of 37.1 bbl. Its share of the global proven oil reserve of 1 702 bbl is 0.15%. Much of its reserves are located in the Sumatra and Java basins, while the focus of recent investment has shifted to deepwater reserves in the Kutei basins off the coast of Kalimantan, West Papua and the Arafura Sea (Figure 4.3).

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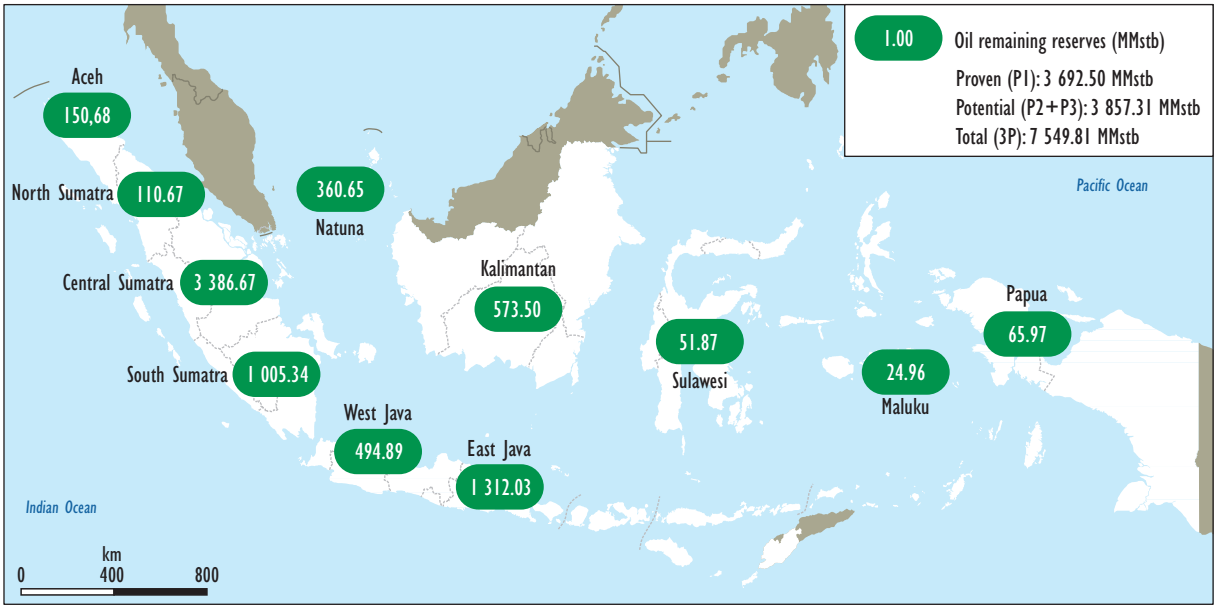
Figure 4.3 Indonesian oil reserves, 2012



This map is 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.

Note: Mmstb = million stock tank barrels.

Source: Directorate-General of Oil and Gas (2013), *Indonesian Oil Reserves*, Ministry of Energy and Mineral Resources, Jakarta.

GOVERNMENT POLICIES

The 2001 Oil and Gas Law (Law No. 22/2001) introduced significant changes to the oil and gas sectors, aiming to ensure effective and sustainable management of hydrocarbon resources in the country. Its centrepiece was the transfer of regulatory responsibilities from Pertamina to two new regulatory bodies, BP Migas and BPH Migas.

In addition, the government introduced a number of new regulations and laws over recent years covering the oil and gas sectors. One of the most significant is the Government Regulation No. 79 of 2010 (GR 79/2010), which provided an overarching framework for financial and tax provisions covering the use of production sharing contracts (PSCs). It included more stringent conditions for cost recovery, which potentially, which retrospectively affect the financial performance of existing PSCs.

Against the backdrop of the dissolution of BP Migas in November 2012, oil and gas law is being revised to provide a legal and institutional setting for a new upstream regulatory body. The details of this law remain unknown at the time of writing.

NATIONAL ENERGY POLICY 2014-50

The draft National Energy Policy (NEP) 2013-50 targets a rapid reduction in oil's share of the national energy mix, from 41%[1] in 2012, to less than 25% in 2025, and to 20% in 2050. The government's strategy is to use oil in the transport and commercial sectors as the last option when an alternative is not available. However, this does not imply an

1. This number excludes biofuels in the energy mix. If one includes biofuels then the share of oil decreases to 37%, as noted in *Handbook of Energy and Economic Statistics of Indonesia* (MEMR, 2013).

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absolute decrease in the volume of oil consumed, which is projected to reach 100 Mtoe in 2025, and 200 Mtoe in 2050, from a current level of 80 Mtoe.

With respect to energy security, the draft NEP indicates the establishment of a strategic reserve, to be regulated and allocated by government, to ensure the country's long-term energy security. Further details are to be provided under the forthcoming presidential regulation.

INDUSTRY REGULATION

INSTITUTIONS

The Directorate-General of Oil and Gas (DGOG), under the Ministry of Energy and Mineral Resources (MEMR), is mainly responsible for oil and gas sector policies, both upstream and downstream. Previously, Pertamina was responsible for all oil and gas affairs under the Oil and Gas Law No. 44/1960 and the Law for Pertamina No. 8/1971. The aforementioned Oil and Gas Law No. 22/2001 introduced the separation of policy, licensing and regulatory functions from Pertamina and assigned them to different institutions. The policy function was transferred and remains with the DGOG, which currently has four directorates responsible for different policy areas:

- The Directorate for Oil and Gas Programme Development formulates policies, plans and programmes for the overall oil and gas sectors, including allocation of natural gas business.
- The Directorate for Oil and Gas Upstream Business Development formulates policy in respect of the development of upstream oil and gas business activities, including pricing of upstream natural gas business.
- The Directorate for Oil and Gas Downstream Business Development carries out the business development policy in respect of downstream oil and natural gas activities, including formulating fuel prices and the calculation of subsidies.
- The Directorate for Oil and Gas Engineering and Environment formulates and implements policies, technical guidance and supervision of environmental protection in the field of oil and gas.

UPSTREAM REGULATIONS

The upstream oil and gas sector was previously regulated by BP Migas, which was established in 2002 as a non-profit state-owned legal entity. The organisation's head was appointed by the president after consultation with the parliament, while it periodically reported to the Minister of Energy and Mineral Resources. In 2012, BP Migas was dissolved by a ruling from Indonesia's Constitutional Court, based on its opinion that it limited the state's ability to maximise the benefits of natural resource management for national welfare.

Presidential Regulation No. 9/2013 ordered the temporary establishment of SKK Migas, a special task force within MEMR, to carry out responsibilities associated with regulating and overseeing the upstream sector. SKK Migas inherited all duties and responsibilities of BP Migas, including providing support to the Minister of Energy and Mineral Resources, in respect of:

- signing co-operation contracts on behalf of the government of Indonesia
- approving the development plan and work programmes and budgets

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- monitoring the implementation of co-operation contracts
- appointing sellers of the state's share of oil and/or gas, which is usually Pertamina.

MEMR, along with SKK Migas, regulates the upstream sector. The DGOG is tasked with selecting and offering upstream blocks, and selecting and awarding bidders prior to signing of contracts by SKK Migas. As mentioned earlier, the DGOG also has authority to approve the prices and pricing formula of oil and gas produced under PSCs.

PRODUCTION SHARING CONTRACTS

Indonesia's upstream oil sector is typically governed by production sharing contracts (PSCs), which are a form of co-operation contract. Currently, a PSC is classified into conventional PSC and non-conventional PSC. The maximum duration of a PSC is 30 years, including a six- to ten-year exploration phase. The revenue sharing structure of Indonesia's PSC model has evolved over time. Under current PSCs, the government is entitled to take a maximum of 10% of production before cost recovery by the contractor, called "first tranche petroleum" (FTP). Once the contractor recovers its production costs, as specified in the aforementioned Government Regulation (GR 79/2010), and acquires a due amount of investment credit, the production revenue, or equity oil, is divided according to a pre-agreed ratio between the government and the contractor. In the case of oil PSCs, the general after-tax division ratio between the government and the contractor is 85:15.

A requirement known as the Domestic Market Obligation (DMO) obliges the contractor to supply 25% to the domestic market. The actual DMO rate may vary according to the PSC. The price at which the contractor is compensated for its DMO delivery is decided by MEMR at the time production commences and the government approves the plan of development, but it may change after the first five years of production.

PRODUCTION INCENTIVES

The operator of the work area and other interest holders are subject to Indonesian income taxes, which consist of the corporate income tax (currently 25%) and branch profits tax (currently 20%), although it can vary depending on the year in which the PSC was entered into. Indonesia currently does not levy resource rent tax or surface rent tax. The contractor's taxable income is broadly calculated as gross production revenue less production costs (E&Y, 2013). Regarding the importing of capital goods and equipment used in exploration activities, for PSCs signed under the Law No. 22/2001, the import duty and value-added tax (VAT) on importation are borne by the Indonesian government through the use of a master list arrangement, while import withholding tax can be exempted upon separate approval from the Indonesian tax office.

To increase the country's domestic oil production, the government is considering additional incentives such as tax allowances for upstream investment in more challenging areas, including deep water, remote regions and EOR projects.

DOWNSTREAM REGULATIONS

Indonesia's regulatory body for downstream oil and gas, BPH Migas, was established by Government Regulation No. 67/2002 to regulate and supervise downstream activities in the oil and gas sectors, including the implementation of downstream oil supply and distribution, the national fuel stock and utilisation of petroleum transport and storage

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facilities. MEMR, on the other hand, has authority to issue licenses for businesses wishing to engage in downstream activities, and to determine the types, standards and quality of oil-based fuel that can be marketed domestically.

INDUSTRY STRUCTURE

UPSTREAM

Both national and international companies are active in the upstream oil sector in Indonesia. Chevron has the largest production share (39% of Indonesia's domestic production in 2013) along with other international oil companies, notably Total and ConocoPhillips. Pertamina was the second-largest producer and produced 200 kb/d, or approximately 24% of domestic production in 2013 (Pertamina, 2013). The recent upstream bidding results indicate increasing interest and participation from Indonesian private companies.

DOWNSTREAM AND REFINING

The downstream sector was officially liberalised in 2001. However, unlike the upstream sector, it is largely dominated by the national oil company, Pertamina, partly because of its near monopoly on the distribution of subsidised fuels.

Refining

Indonesia has ten refineries with a total refining capacity of nearly 1.2 mb/d as of 2012, of which eight are operated by Pertamina. The other two are operated by private companies – TPPI and TWU – but their combined capacity represents only 10% of Indonesia's refining capacity. A notable aspect of Indonesian refineries is their relatively small capacity; only two have a capacity over 200 kb/d (Table 4.1).

Table 4.1 Indonesian refineries as of 2013

Refinery	Capacity (kb/d)	Location
Sungai Pakning	50	Sumatra
Dumai	127	Sumatra
Plaju	127	Sumatra
Balongan	125	Java
Cilacap	348	Java
Balikpapan	260	Kalimantan
Kasim	10	Papua
TPPI Tuban	100	Java
TWU	16	Java
Cepu	4	Java
Total	**1 167**	

Source: IEA (2014a), *Oil Information*, OECD/IEA, Paris.

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At the same time, nearly half of domestic refining capacity is concentrated in Java, with three refineries accounting for 26% of total capacity located in Sumatra. Kalimantan and Papua each have one refinery. The government aims to add 0.6 mb/d of extra capacity (two refineries of 300 kb/d capacity each) to reduce the country's import dependency on oil products, thereby increasing the country's dependency on imported crude oil. Only the two largest refineries, Cilacap and Balikpapan, can process imported sour crude oil, as the other refineries have inadequate capability to process such crude.

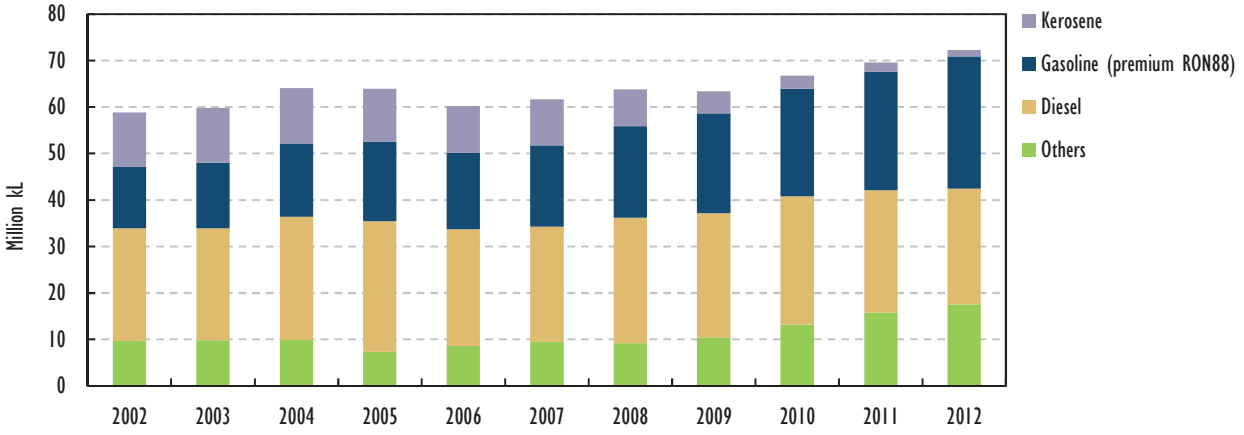
To reduce import dependency of light distillate products and meet increasing domestic demand for higher-grade products, Pertamina is constructing a residual fluid catalytic cracking unit in its Cilacap refinery. This will produce an additional 1.9 million kilolitres (kL) of high-octane fuel and 352 000 tonnes of LPG per year, and is planned to start operation in mid-2015.

Retail

Pertamina's monopoly in the retail market ended in 2004 when the government granted a retail licence to Shell and Petronas. However, Pertamina still has a dominant presence in Indonesian retail product markets, with a market share of 88% by sales volume and 95% by number of filling stations. Pertamina also supplies 99% of subsidised fuels.

Gasoline (octane 88) had the largest share of total national sales in 2012, at nearly 40%, followed by automotive diesel with a share of 34% (Figure 4.4).

Figure 4.4 Oil fuel sales, 2002-12



Source: Directorate-General of Oil and Gas (2014), "Oil and gas downstream policy", presentation to IEA, March 2014, Ministry of Energy and Mineral Resources, Jakarta.

The reduction in kerosene consumption between 2002 and 2012 is noteworthy, supported by the government programme to convert kerosene use to LPG in the residential sector. The growth in consumption of higher-grade, non-subsidised fuels, such as gasoline (octane 92 and 95) is also noteworthy, increasing from zero consumption in 2002 to over 800 000 kL in 2012, although their share remains at 1%. Although a growing number of passenger vehicles will run on higher-grade fuels, the prospects for further increases in demand for these premium products depend on their price disparity with subsidised gasoline.

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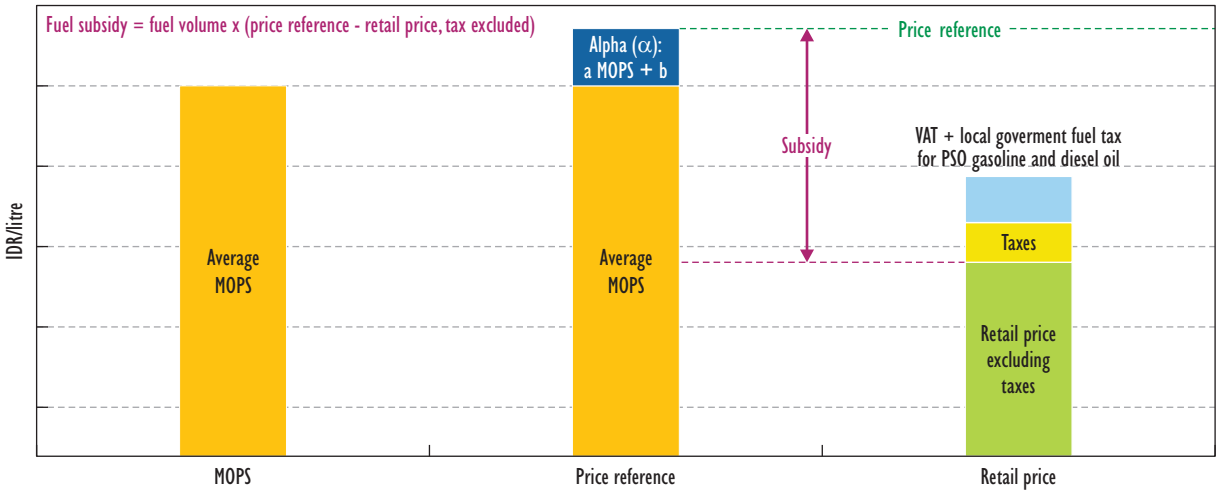
PRICING

The government of Indonesia is authorised by law to determine the price of oil and gas products in the domestic market. The Decision of the Constitutional Court (Case No. 002/PUU-I/2003) states that prices for petroleum and gas fuels shall be stipulated by the government, a point that was later reinforced by Government Regulations No. 36/2004 and No. 30/2009.

The Indonesian Crude Price (ICP) serves as a benchmark for national oil product pricing, set periodically by MEMR together with Pertamina and other related government bodies, based on the movement in the price of a basket of selected internationally traded crudes. The ICP is used as a reference price for calculating gross revenues under oil PSCs. The price set for DMO fuel under oil PSCs is linked to the ICP at a rate of 100% for the first five years of production, then decreasing to 25% or any pre-agreed percentage of the Mean of Platts Singapore (MOPS) thereafter.

In the downstream sector, the government also determines oil product prices in relation to the MOPs. VAT of 10% and motor vehicle fuel tax of 5% are levied on oil products (Figure 4.5).

Figure 4.5 Fuel subsidy structure



Note: IDR = Indonesian rupiah.

Source: Directorate-General of Oil and Gas (2014), "Oil and gas downstream policy", presentation to IEA, March 2014, Ministry of Energy and Mineral Resources, Jakarta.

Fuel subsidies

The Indonesian government has subsidised the retail price of fossil fuels since 1967. Currently, three petroleum products, kerosene, premium gasoline (octane 88) and diesel, are subsidised by the government budget under a Public Service Obligation (PSO). As international oil prices have continued rising and Indonesia's oil demand and imports grown rapidly, the country's oil subsidies have increased considerably. The government's preliminary estimate suggests that oil subsidies amounted to IDR 210 trillion in 2013, nearly USD 20 billion, and this figure was greater than the revised budget allocation for subsidies at IDR 199.9 trillion. Representing nearly 13% of government budget expenditure in 2013, subsidies are considered to be a main factor in pushing the

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government budget deficit to 2.25% of GDP. According to BPH Migas, 55% of subsidies went to Java and Bali, where consumption is concentrated, followed by Sumatra (25%).

As such, the Indonesian government has made efforts to increase the price of subsidised oil products, including increasing gasoline prices by 44% and diesel prices by 22% in mid-2013. As of 2014, prices currently stand at IDR 6 500 per litre of gasoline, IDR 5 500 per litre of diesel and IDR 2 500 per litre of kerosene. However, these prices are still considerably lower than international prices. For comparison, as of May 2014, Shell gasoline (octane 92) and diesel were priced at IDR 10 850 and IDR 12 750 in Greater Jakarta (Jabodetabek).

To reduce the fiscal burden and promote fuel efficiency, MEMR along with other related ministries drafted a roadmap to phase out subsidies, and has already implemented a number of elements including discontinuing subsidies for industrial consumers.

OIL SUPPLY STRUCTURE

PORTS AND PIPELINES

The distribution of refined products is a challenge for Indonesia, as the country is composed of over 17 000 islands. For fuel transport, the country has over 600 oil tankers with a combined transporting capacity of over 6.2 million kL, 680 road tankers with a total capacity of 11 1000 kL, and 1 030 rail tankers with a capacity of 25 000 kL in total.

The country has over 25 major crude oil terminals and sea storage facilities, with a combined storage capacity of around 10 mb. In addition, Pertamina owns around 17 main oil terminals with a combined hourly discharging capacity of 88 400 kL (or 556 thousand barrels per hour [kb/hr]). Those ports are mainly for charging and discharging oil products, especially gasoline and diesel. The two largest ports are Turban Transit Terminal with 12 300 kL/hr discharge capacity, and Surabaya port with 10 800 kL/hour capacity.

While over half of refined products are currently consumed in Java and Bali, consumption is expected to increase rapidly in the other regions, which suggests an increasing need for inland distribution infrastructure in these regions.

The country has nine major product pipelines, eight of which are located in Java. The other pipeline is located in Sumatra, connecting Kertapati with Plaju. The combined maximum flow capacity is 3 520 kL/hr (equivalent to 22 kb/hr or 531 kb/d). These pipelines mainly connect refineries with storage facilities in Java. The country lacks internationally connected pipelines with neighbouring countries.

STORAGE CAPACITY

Indonesia has eight regional storage facilities. The country's combined crude oil storage capacity in its main crude terminals and floating facility amounts to 10.3 mb. Total product storage capacity amounts to 4.8 million kL (equivalent to 30.3 mb): 3.5 million kL (or around 22 mb) in Pertamina terminals, 1.2 million kL (or 7.5 mb) in private terminals, and 130 000 kL (or around 820 kb) in floating storage. Pertamina is the main storage stakeholder, owning 72% of the country's total storage capacity. Some 52% of product storage capacity is located in Java and Bali, which form the country's oil demand centre, followed by Sumatra (26%), Kalimantan (8%), Sulawesi (7%) and Maluku (4%).

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Even assuming that all product storage facilities are fully filled with refined products, they can only meet 18 days of average oil demand using current domestic oil demand of 1.6 mb/d. Including crude oil storage capacity adds an additional six to eight days to this figure.

To respond to the lack of adequate storage capacity, as well as rapidly increasing oil demand, Pertamina plans to expand its existing product storage capacity in Sambu and Tanjung Uban (near Singapore in Sumatra), Kotabaru (in Kalimantan), Pontianak, Bau-Bau, Banjarmasin and Bitung, in addition to constructing new storage sites. Plans for the Sambu site aim to double its storage capacity to 264 000 kL (or 1.9 mb). This additional capacity is expected to come online in 2016. The facility will then be expanded up to 800 000 kL (or 5.25 mb). The project in Tanjung Uban is expected to expand its existing capacity to 200 kL (1.26 mb). Other private companies also have several plans to increase their product storage capacities up to 5 million kL (or 31.5 mb). These new storage facilities will double the existing storage capacity of the country.

EMERGENCY PREPAREDNESS AND PLANNING

EMERGENCY RESPONSE POLICY

Law No. 30/2007 on energy provides the legal basis for the National Energy Council (NEC) to define emergency measures in case of energy crisis. According to the law, the NEC has developed a draft presidential regulation and a procedure for managing energy crisis and emergency. The draft presidential decree aims to secure stable supply of energy resources such as oil products (including LPG), natural gas and electricity through the following measures:

- releasing energy buffer reserves
- increasing energy imports
- international co-operation
- introducing export restrictions
- mandating energy savings
- introducing demand restraint measures
- fuel switching and energy diversification
- purchase of excess power.

As the president has approved the draft presidential decree in principle, it has entered a harmonisation stage to ensure that it is congruent with other legislation. It is expected to enter into force by the end of 2014. Following validation of the presidential decree, the government will specify detailed procedures and roles in a ministerial decree.

Indonesia has yet to establish a National Emergency Strategy Organisation (NESO) structure, but the government plans to establish a decision-making structure in case of energy supply crisis. In the plan, the NEC, chaired by the president, is the permanent core body of the country's decision-making process in case of energy crisis. The vice president serves as vice chairman of the NEC, and the minister, MEMR, acts as executive chairperson. The NEC both comprises government representatives from related ministries, including BAPPENAS (Ministry of National Development Planning), Ministry of

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Finance and Ministry of Transport, and representatives from key stakeholders, including industry, civil society and academia upon approval of the parliament.

Government Regulation No. 36/2004 empowers BPH Migas with overall management of stocks, including determining and managing fuel distribution and reserves, supervising domestic fuel distribution and fuel reserve provision, managing the utilisation fuel reserve when fuel scarcity occurs, and recommending administrative sanction. The MEMR, on the basis of recommendations from BPH Migas, will give a licence for downstream activity, decide administrative sanctions in case of infringement, and determine annual fuel quota and reserves.

In the event of an oil supply emergency, the NEC Daily Chairman will convene either a NEC board meeting[2] or a NEC plenary meeting[3] to evaluate whether the crisis meets the criteria for action according to the presidential decree. If the disruption is recognised as local, the MEMR will take the lead in determining measures, while the NEC Secretariat co-ordinates action in case of national disruption.

Box 4.1 Regional co-operation on oil supply disruptions

In 1986, member countries of the Association of Southeast Asia Nations (ASEAN) established the ASEAN Petroleum Security Agreement (APSA). This regional treaty mitigates the impact of an oil supply disruption in one or more of its member countries by activating a sharing scheme – the ASEAN Emergency Petroleum Sharing Scheme – for crude oil and petroleum products. In 1999, ASEAN energy ministers agreed to revise the 1986 APSA to incorporate both short-term response measures (e.g. demand restraint, fuel switching and a co-ordinated emergency response mechanism – ASEAN CERM), and medium and/or long-term measures. The ASEAN CERM aims to serve as a framework for regional consultation and co-ordination to facilitate oil allocation on a voluntary and commercial basis in times of oil crisis.

After Indonesia ratified the revised APSA in February 2013, it came into effect in March 2013. However, it has yet to be made operational as it requires a set of standards to activate the scheme. While Indonesia's participation on regional energy security co-operation is seen as essential, it could also itself benefit from the APSA in case of domestic oil supply shortage. Optimisation of the APSA will be critical to allow prompt co-ordination among the ASEAN countries.

STOCKS

Indonesia does not have either public emergency oil stocks or compulsory industry stocks. Operational stocks exist in the commercial supply chain. However, the government is aiming to create a national energy reserve system, including strategic energy reserves, energy buffer reserves (EBR) and operational reserves.

Strategic energy reserves are energy resources that the government will reserve and regulate to ensure long-term energy security. This is basically defined as proven reserves.

EBR can be categorised as public emergency stocks. The EBR will be held by the government based on Law No. 30/2007 on Energy and must be used only for emergency

2. An NEC board meeting is convened without the president of Indonesia. It is normally held at least once a month.

3. An NEC plenary meeting is held under the chairmanship of the president of Indonesia. It is held once every six months.

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purposes. The NEC made a proposal to hold an equivalent of 30 days of net imports as EBR, which it plans to start building from 2017, while a final decision has yet to be made on EBR management.

EBR components are expected to be crude oil, motor gasoline, diesel, LPG, and aviation fuel. However, the types of stock will be determined in an NEC decree following the Presidential Decree. The EBR will be located at the centres of greatest energy demand such as Java, and close to existing robust energy infrastructures, such as East Kalimantan, taking into consideration geographic and geological conditions. The government is analysing EBR arrangements to avoid unnecessary expense.

Operational Reserves are set to be provided by industry to ensure stable energy supply based on Law No. 22/2001 and the Government Regulation on Downstream Oil and Gas No. 36/2004. As there is no obligatory volume set for operational reserves in the legislation, Pertamina holds between 21 and 23 days of stocks in total, while private oil companies hold up to 21 days of operational stocks. The government aims to increase this to 30 days of consumption. However, the lack of storage capacity remains a major problem. Given that rapidly growing oil demand will require higher operational stock levels, the government is encouraged to facilitate an open oil market so as to realise the necessary future investments.

Indonesia has no bilateral stockholding agreement with other countries. However, given the lack of sufficient domestic storage capacity in the country, it is reported that almost one-fifth of product storage in Singapore is used for Indonesia.

DEMAND RESTRAINT

No legal framework exists for demand restraint measures, although local governments may impose demand restrictions to control consumption of subsidised fuel according to Ministerial Regulation No. 1/2013 on Control of Fuel Consumption. This is implemented by request from Pertamina when subsidised fuel consumption in a region exceeds the regional quota. Local police have been deployed several times to support the demand restrictions. Pertamina has an internal priority list of customers, such as power plants and demand centres such as Java.

Pertamina also has an operational allocation system, a fuel distribution system, for supplying available oil to disrupted areas, even though the government has no specific legal authority to instruct the industry to implement the allocation mechanism. When stock level is below the acceptable level in an area, alternative supply will be delivered from available storage near the disrupted area. In case of those alternative supplies being insufficient, any available supply will be delivered. This allocation mechanism was activated when there was a tank fire at the Cilacap refinery in April 2011, and again when oil supply was halted to a power plant due to pipeline maintenance in July 2008.

As no measures other than demand restraint can currently be deployed to mitigate oil supply disruptions, the government should prepare formal procedures for demand restraint in cases of emergency, in particular drafting a pre-set media strategy and identifying priority users for oil allocation. Furthermore, maintaining the fixed price mechanism for subsidised fuels during an oil supply crisis should be avoided and a flexible price mechanism should be developed, reflecting price movement in international oil markets and reminding consumers of the oil shortage.

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ASSESSMENT

Indonesia has benefited significantly from its large petroleum resources, at one time being a member of OPEC and one of the world's major crude exporters. However, it faces the challenge of declining domestic oil production. As domestic oil demand has grown rapidly bolstered by the country's economic growth, Indonesia's dependence on imported oil has also increased, now reaching over 30% of total domestic demand, a figure that is expected to increase further. Although a number of projects are due to enter the production phase in the coming years, Indonesia's long-term rate of oil production is projected to decline.

The government recognises the importance of foreign direct investment in the upstream sector to increase domestic production, which can bring necessary technology and finance. This is at a time when an increasing number of upstream projects are moving to more challenging areas and becoming more complex by nature, for example, involving high pressure, high carbon dioxide levels and high sulphur content. As such, the government has introduced incentives and programmes to attract investment, especially for EOR and offshore projects. However, the country's investment climate appears to be deteriorating. For instance, sudden dissolution of its upstream regulator, BP Migas, has created considerable uncertainty on the validity of upstream contracts with the government. Furthermore, retroactive changes to PSCs and lengthy and complicated administrative procedures have been pointed to as the main impediments to upstream investment.

As Indonesia has insufficient refining capacity to meet domestic demand, it is also dependent on imported fuels. However, it is also well positioned to receive fuel supplies from major refining countries in the region, namely Singapore, India, Malaysia and Korea. Expanding domestic refining capacity should be based on economic consideration of developments in the global and regional refining sector. Consideration should also be given to the fact that the global market for oil products is geographically less concentrated than the market for crude oil, which has to be imported at a larger scale once new refineries are built. Given Indonesia's high level of dependence on imports for light distillate products and its growing demand for cleaner and higher-grade fuels, the government should consider upgrading its existing refineries rather than expanding its nominal capacity.

In the downstream sector, while technically liberalised, Indonesia's national oil company, Pertamina, enjoys a dominant position, owning a majority of refining capacity and 90% of retail market share, and controlling almost all subsidised fuel distribution. Although the phase-out of current fuel subsidies may attract greater private participation in the sector, the government should ensure a level playing field for all market players to bring more competition, to the benefit of Indonesian consumers.

Over USD 20 billion is spent on fuel subsidies in Indonesia every year, while only a small proportion of this amount reaches the poor. The current subsidy regime is inefficient and untargeted, places a considerable burden on the government budget, and consumes limited financial resources that are much needed for investment in other infrastructure. The government should phase out of fossil fuel subsides in line with its roadmap and move to a fluctuating price.

Increasing domestic demand and imports of oil require a significant expansion of related infrastructure, such as import terminals, inland distribution networks and crude and product storage facilities. The government should closely monitor infrastructure capacity needs and facilitate timely and sufficient investment by ensuring planning and implementation without delay.

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The government of Indonesia has made significant efforts to enhance its national energy security. These include the formation of the NEC, a recommendation of the last IEA *Energy Policy Review of Indonesia* (IEA, 2008), and empowering it to define emergency measures in case of energy crisis. Although the country currently does not have a NESO structure, the government plans to establish a decision-making structure for energy supply crisis in the draft presidential regulation and procedures for determining energy crisis and emergency. The responsibilities of each stakeholder should be clarified for effective co-ordination across the relevant authorities, in co-operation with the industry. It is recommended that the government of Indonesia, together with the other Task Force member countries, continue progress to make regional energy security co-operation operational within the framework of APSA.

RECOMMENDATIONS

The government of Indonesia should:

Upstream

- ☐ *Empower its upstream regulatory body with sufficient institutional capacity and build public trust to ensure effective oversight and management of PSCs, and eventually increase national revenues from the oil sector.*
- ☐ *Streamline and accelerate regulatory procedures by cutting unnecessary regulations and increasing inter-ministerial co-ordination.*
- ☐ *Avoid applying ex-post regulations and laws to existing PSCs and ensure the sanctity of legal contracts to restore investors' confidence.*
- ☐ *Ensure sufficient and timely investment in EOR and deepwater projects to increase domestic oil production.*

Downstream

- ☐ *Resolutely continue the implementation of fossil fuel subsidy reform to increase competition and investment in the downstream sector, and implement plans to accurately measure the volumes of subsidised fuel consumption.*
- ☐ *Take into account global developments in the refining sector when planning the expansion and upgrading of the domestic refining capacity, to ensure optimal economic outcomes.*
- ☐ *Ensure sufficient and timely investment in oil distribution and storage infrastructure.*

Energy security

- ☐ *Specify and enhance internal understanding of operational procedures for emergency response, including roles, responsibilities and contact arrangements of all emergency stakeholders.*
- ☐ *Take a step-by-step approach to establishing emergency stocks, bearing in mind that stockholding costs need to be borne by stakeholders in any case, and conduct regular inspections of operational stocks and EBR once they are established.*
- ☐ *Consider a mechanism for emergency stock release in parallel to preparing to hold these stocks.*

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5. COAL

Key data (2013 estimated)

Production: 485.2 Mt of steam coal and 2.7 Mt of coking coal

Exports: 329 Mt

Share of coal (2012): 13.9% of TPES and 48.7% of electricity generation

Consumption by sector (2012): power generation and other transformations 84.3%, industry 15.7%

OVERVIEW

BACKGROUND

Indonesia is one of the world's leading coal producers and since 2012 has been the world's leading exporter of coal, reflecting its status as a major source of energy for nearby Asian markets. In 2013, the country produced 489 million tonnes (Mt) of coal and was the fourth-largest coal-producing country in the world, behind China, the United States and India.[1] Indonesia exported 329 Mt of coal in 2013, almost all of which was steam coal,[2] representing around 35% of the global steam coal trade. Indonesian coal exports comprise mainly sub-bituminous and bituminous steam coal; it produces and exports very little coking coal, accounting for about 1% of its coal exports. Indonesia was the largest exporter of both total coal and steam coal in 2013. Domestic consumption amounted to 63 Mt in 2013, with much of this being low-grade coal, sub-bituminous coal and lignite of relatively low calorific value. Historically, some anthracite was once mined, although this has not occurred since 2000.

The policies and regulatory framework governing the coal mining sector have undergone considerable change since 1998, accompanied by rapidly rising export volumes. This is largely due to Indonesia's democratisation and the decentralisation of government, bringing greater regional autonomy to the coal mining sector. This has led to the rapid expansion of Indonesia's coal industry and a surge in exports; at the same time, local communities have started demanding greater benefits from the mining industry, increasingly calling for companies to be more transparent and promote better social and environmental outcomes. Recent governments have therefore been challenged to balance the short-term maximisation of benefits, in terms of mining revenue, with the medium- to long-term development of a sustainable industry.

However, conflicts between companies and community have increased in frequency and magnitude since 2000, and are starting to affect the development of Indonesia's mining sector. Indonesian civil society organisations, such as Jatam and Walhi, are playing an important advocacy role for local communities with the coal industry, demanding that

1. There are discrepancies between the data and statistics on coal from the IEA and those from the government of Indonesia. These discrepancies are partly explained by different estimates concerning illegal mining.

2. Steam coal includes all bituminous coal, sub-bituminous coal and lignite used for thermal (non-coking) purposes.

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mining companies recognise "local rights", which has sometimes led to conflict between companies and civil society. Consequently, it is essential for mining companies to demonstrate better environmental and social responsibility to ensure communities in the host areas benefit from mining sector activities.

Indonesia has significantly increased its domestic consumption of coal, particularly in the power sector. The first part of its 10 000 megawatt (MW) Fast Track Program focused mainly on adding coal-fired power stations. There are now 50 coal-fired thermal power plants, the majority of which are located on Java, Sumatra and, to a lesser degree, Kalimantan. These power plants have a total installed capacity of 19 404 megawatt electrical (MW_e).

SUPPLY AND DEMAND

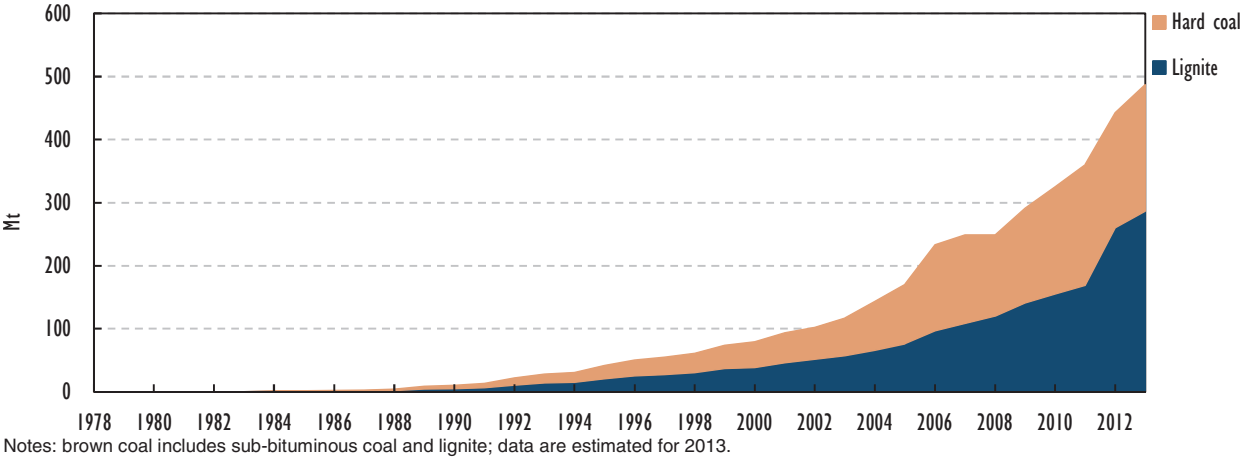
SUPPLY

Coal resources extend across the archipelago, occurring in most of Indonesia's 34 provinces. The most significant reserves of coal are found on the islands of Sumatra and Kalimantan, followed in importance by coalfields on Sulawesi, Papua, Java and Malaku. Primary energy supply from coal in Indonesia amounted to 29.8 million tonnes of oil-equivalent (Mtoe) in 2012. This accounted for 13.9% of total primary energy supply (TPES) in the country. The supply of coal has grown at an annualised rate of 6.9% over the ten-year period to 2012, and as such its share in the energy mix has increased from 9.3% in 2002. Compared to other fuels in the country's energy mix, the use of coal has experienced the strongest growth over the past decade.

In 2011, Indonesia held 13 512 Mt of hard coal reserves, with 73 299 Mt of hard coal resources. Hard coal reserves and resources were ranked tenth and eleventh in the world in 2011, respectively. With respect to lignite, Indonesia had 9 002 Mt of reserves and 19 021 Mt of resources. This ranks its lignite reserves as sixth highest in the world and its lignite resources as twelfth highest (IEA, 2014a).

Indonesia is the third-largest hard coal producer of all OECD non-member countries and recently managed a spectacular upsurge in production. From 2011 to 2012, Indonesia increased production by 39 Mt, and from 2012 to 2013, by 45 Mt, maintaining the upward trend (Figure 5.1). This represents an annual growth of around 10%, close to the remarkable average over the last decade of 14.4%. With respect to the energy content, the increase is slightly lower, pointing to the declining calorific value of incremental production.

Figure 5.1 Production of hard coal and brown coal, 1978-2013



Notes: brown coal includes sub-bituminous coal and lignite; data are estimated for 2013.

Source: IEA (2014b), *Coal Information*, OECD/IEA, Paris.

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Indonesia is a large country and it is possible that additional coal resources can be identified in the future. It is also possible that more of Indonesia's coal resources may become characterised as reserves, over time. Indeed, over the period from 2010 to 2013, coal resources and reserves both increased in Indonesia (Table 5.1).

Table 5.1 Indonesian coal resources and reserves, 2010-13

	Resources (Mt)					Reserves (Mt)		
	Hypothetic	Inferred	Indicated	Measured	Subtotal	Probable	Proven	Subtotal
2010	34 889	32 199	15 810	22 290	105 188	15 601	5 531	21 132
2011	33 554	35 625	27 059	24 100	120 338	17 758	10 259	28 017
2012	32 447	35 393	26 400	24 687	119 422	19 359	9 620	28 979
2013	19 557	32 126	29 438	39 450	120 571	22 458	8 899	31 357

Source: Directorate-General of Mineral and Coal (2014), "Some Aspects of National Coal Policy", presentation to IEA on 12 March, Ministry of Energy and Mineral Resources, Jakarta.

RESERVES AND TRENDS

Approximately 75% of Indonesia's recoverable coal reserves can be surface mined, while the remaining 25% can be accessed with underground mining. The Indonesian coal sector is dominated by domestic companies, and a small number of large companies participate in the coal mining concessions granted most recently. At present, coal mining is most concentrated in South Sumatra, East Kalimantan and South Kalimantan. Exports comprise mostly sub-bituminous coal with low ash and sulphur content, complemented by some bituminous coal and lignite, whereas domestic consumption comprises mainly sub-bituminous coal and lignite. Table 5.1 summarises recent coal production, exports and domestic consumption data, as reported by the Ministry of Energy and Mineral Resources (MEMR). These data illustrate the rapid growth in coal mining, particularly for expanding Asian export markets.

The rapid growth in coal production followed the issuance of the 2009 Mining Law, as recommended by the previous *Energy Policy Review of Indonesia* (IEA, 2008). The 2009 Mining Law introduced a new licensing system replacing the Coal Contract of Work (CCoW) system. Nonetheless, a large number of existing contracts do not comply with existing laws and regulations. This is partly a result of conflicting regulations and capacity problems at the national, provincial and local levels.

The Indonesian government aims to stabilise total production under the National Energy Policy and wants domestic consumption to account for a greater portion of total coal production as the nation's economy continues its rapid growth. Thus it is expected that domestic consumption will rise and exports level off.

The mineral and coal sector directly employs 742 000 people, approximately 178 152 in coal mining and 132 314 providing mining services including minerals. The remaining are employed in the hard minerals sector.

DEMAND

The domestic supply of hard coal and sub-bituminous coal in Indonesia was 1 Mt and 59.2 Mt in 2012, respectively. Of this, around 84.3% is used in power generation while

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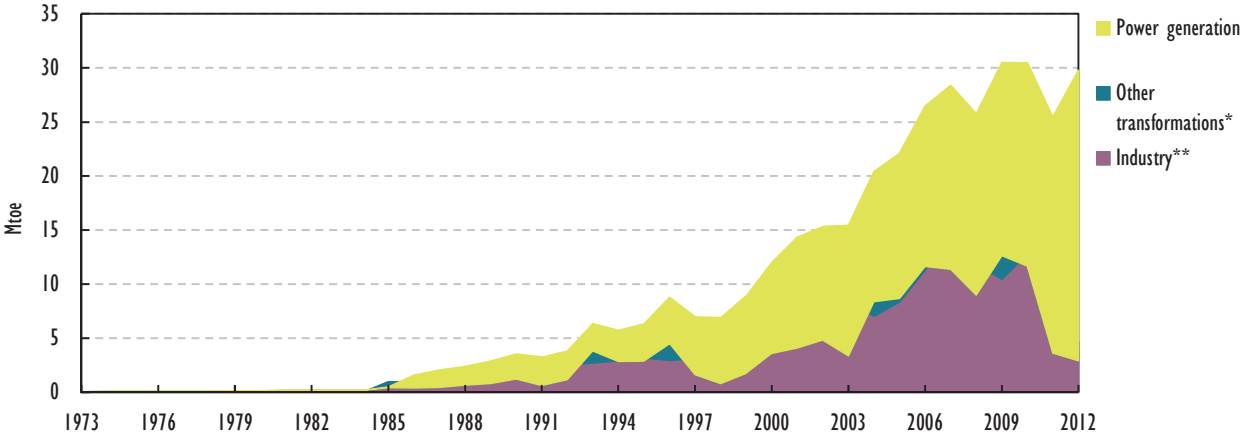
the remainder is used in industry (e.g. cement, fertiliser, metals). The use of coal in power generation has grown by 9.2% per year since 2002, while coal consumption in industry has grown by 0.5% per year. As such, industry's share of total coal consumption has fallen from 32.1% in 2002 to 15.7% in 2012 (Figure 5.2).

Figure 5.2 Coal consumption by sector, 1973-2012



* *Other transformations* includes refining and energy own-use.

** *Industry* includes non-energy use.

Source: IEA (2014c), *Energy Balances of Non-OECD Countries 2014*, OECD/IEA, Paris.

As an abundant indigenous fuel, coal remains a primary component of Indonesia's efforts to provide electricity access to a growing percentage of its population. At present, 50 coal-fired power plants are operational in Indonesia with a capacity of 19 404 MW, the majority of which are located in Java.

TRADE

Indonesia is the largest exporter of both total coal and steam coal, and an important supplier to the growing energy markets of Asia. Nearly all hard coal produced is exported, while 77% of sub-bituminous coal and lignite is sold to foreign markets. The country has seen impressive export growth since the beginning of the 21st century. In 2000, Indonesia exported around 57 Mt, an amount that has since increased more than six-fold in 12 years (Figure 5.3). Indonesian coal exports have particularly surged since 2008. Incremental exports between 2008 and 2012 total over 180 Mt (2008 base year). Consequently, Indonesia is one of the driving forces behind the spectacular growth in the global seaborne coal trade, accounting for more than 60% of incremental seaborne trade in thermal coal since 2000. While the country produces less than 6% of global coal, it has a 43% market share of global seaborne steam coal export volumes.

In 2013, Indonesia exported 329 Mt of coal, representing over a quarter of the coal and over a third of the steam coal traded globally, duly replacing Australia as the world's largest exporter of coal on the basis of both tonnage and energy content.

China and India are the main drivers of that growth, as China increased its Indonesian imports by 101 Mt and India by 70 Mt over the last five years (Figure 5.3). In 2012, China accounted for 33% of Indonesian exports and India for 25%. Coal exports support a significant part of the Indonesian economy, although due to its relatively low calorific value and high moisture content, Indonesian coal is sold at a discount when comparing

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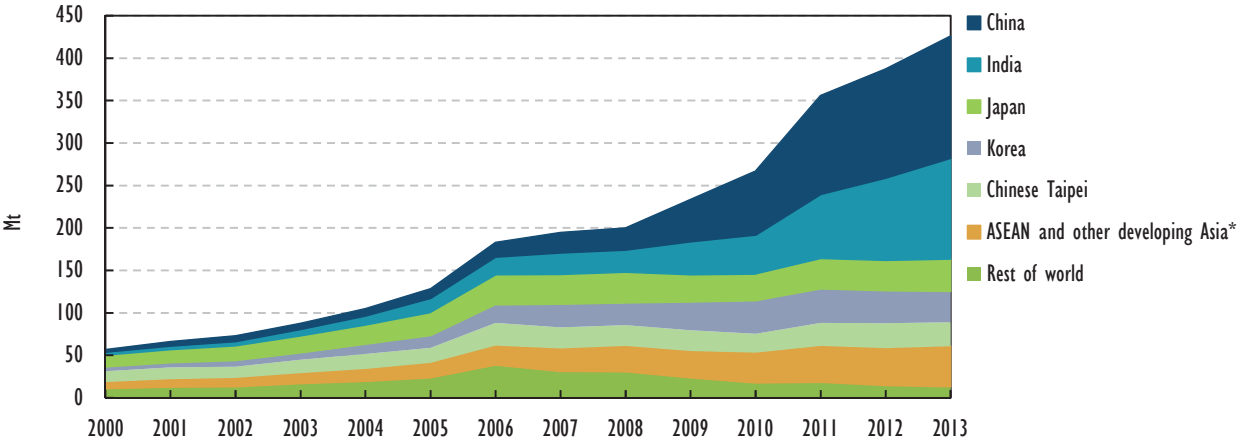
prices adjusted for energy content. This attracts demand from India and China, where coal plants are suited to handling this quality of coal. IEA data indicate that the export surge continued in 2013, although torrential rains were reported in Kalimantan and Sumatra in the first quarter of 2013. The production volumes of large producers, such as Bumi and Adaro, rose in the first half of 2013. The average selling price, however, dropped by 20%, resulting in tougher economic conditions, particularly for smaller producers. Furthermore, competition for exporting infrastructure, such as barge loading slots in South Kalimantan has increased.

Figure 5.3 Indonesian coal exports by destination



* Bangladesh, Brunei Darussalam, Cambodia, China (People's Republic of), Democratic People's Republic of Korea, Malaysia, Mongolia, Myanmar, Nepal, Pakistan, the Philippines, Singapore, Sri Lanka, Thailand, Viet Nam, and other non-OECD Asian countries (Afghanistan, Bhutan, Cook Islands, East Timor, Fiji, French Polynesia, Kiribiati, Lao PDR, Macau, Maldives, New Caledonia, Papua New Guinea, Samoa, Solomon Islands, Tonga, Vanuatu).

Source: IEA (2014b), *Coal Information*, OECD/IEA, Paris.

With a market share of 41% in 2012 (and increase of 20 Mt over 2011), Indonesia is the main supplier of Chinese imports. In fact, Indonesian exports to China have risen by over 800% since 2008. Additionally, the steady appreciation of the Yuan renminbi (CNY) against the US dollar (USD) and the Indonesian rupiah (IDR) since 2010 has created a competitive advantage for imported coal versus domestic coal.

COAL TRANSPORT AND EXPORT INFRASTRUCTURE

The ability of Indonesia's coal mining industry to satisfy demand depends on adequate transport infrastructure. Coal transport to seaports in Indonesia is currently dominated by trucks on private haul roads, rail wagons, river barges and conveyors. Use of public roads faces opposition due to the deterioration of roads caused by heavier vehicles, and related safety concerns. New railways are planned to meet growing transport requirements. For example, the government is currently considering a 422 kilometre (km) publicly owned railway on Kalimantan (connecting Puruk Cahu to Mangakatip/Batanjung), to be used by both passenger rail and, primarily, more efficient coal transport. The government has a master railway plan for both passenger and freight transport, aiming to increase the 19 Mt of freight moved by rail in 2009 to 1 billion tonnes in 2030. This includes a plan to complete a double-track project on Java, which would increase freight capacity, and thereby lessen truck traffic and congestion on the roads. Table 5.2 lists coal ports and jetties in Indonesia, including river ports.

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Table 5.2 Coal ports and jetties in Indonesia

Port, province	Capacity 2010 (DWT)	Port, province	Capacity 2010 (DWT)
Air Tawar,* South Kalimantan	7 500	Pulau Baal, Bengkulu	40 000
Apar Bay, South Kalimantan	6 000	Satui,* South Kalimantan	5 000
Balikpapan, East Kalimantan	65 000	Sembilang, South Kalimantan	7 500
Beloro, East Kalimantan	8 000	Taboneo, South Kalimantan	15 000
IBT, South Kalimantan	200 000	Tanah Merah, East Kalimantan	60 000
Jorong, South Kalimantan	7 000	Tanjung Bara, East Kalimantan	210 000
Kelanis,* South Kalimantan	10 000	Tanjung Merenggas, East Kalimantan	90 000
Kertapatl, South Sumatra	7 000	Tanjung Pemancingan, South Kalimantan	8 000
Loa Tebu, East Kalimantan	8 000	Tanjung Peutang, South Kalimantan	8 000
Muara Berau, East Kalimantan	8 000	Tanjung Redep, East Kalimantan	5 000
Muara Pantai, East Kalimantan	150 000	Tarahan, Lampung	40 000
Muara Satui, South Kalimantan	7 500	Tarakan, East Kalimantan	7 500
North Pulau Laut, South Kalimantan	150 000	Telek Bayur, West Sumatra	35 000
Subtotal East Kalimantan	**611 500**	**Subtotal South Kalimantan**	**431 500**
Subtotal Sumatra	**122 000**	**Total**	**1 165 000**

* Denotes river ports.

Note: DWT = deadweight tonnes.

Source: Directorate-General of Mineral and Coal, (2014), "Some Aspects of National Coal Policy", presentation to IEA on 12 March, Ministry of Energy and Mineral Resources, Jakarta.

INDUSTRY STRUCTURE

The Indonesian coal mining industry is dominated by six large, domestically-owned private and state-owned coal mining companies, which together account for 75% of total production. PT Adaro is the largest, producing more than 47 Mt in 2012, followed by Kaltim Prima Coal. Other major producers include PT Kideco Jaya, PT Arutmin, and PT Berau. Foreign-owned mining companies only have a marginal share of coal mining activities and concentrate on the extraction of hard rocks. In addition, large numbers of illegal and semi-legal mining operators exist, as do communities and individuals mining for their own consumption.

Industry is disputing the alteration of the terms of several mining concessions, following the government's belated start to the renegotiation of existing concessions as stipulated in the 2009 Mining Law. Some of the large players have accepted the new terms, but several others have not. While certainty and predictability, as well as streamlined approval and permitting processes, would go a very long way indeed towards assuring investors that Indonesia has a business climate that is favourable for economic development, the revisions could lead to more transparent and legally compliant mining concessions.

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Small-scale mining by local residents, so-called "people's mining", is allowed by the establishment of village unit co-operatives. However, over the past decade, illegal small-scale mining without permits has increased dramatically. Although it is difficult to pin down the exact number of illegal miners, a rough government estimate might range as high as 20 000 to 30 000 workers. Illegal production is hence thought to be at least between 30 Mt and 50 Mt per year.

Illegal, and therefore unreported, coal mining is an activity with potentially serious ramifications. It can undermine Indonesia's energy policy, as it casts uncertainty on the coal reserves and production data upon which part of that policy is based.

It also poses severe risks to Indonesia's natural environment and forests, since illegal mining need not comply with mine safety and environmental compliance regulations, or best practice. Illegal mining is a severe cause of forest degradation and destruction, and water and air pollution.

The illegal production numbers also raise doubts over the government's ability to effectively limit production, and they point to substantial losses in government revenue as well as to unfair competition.

Box 5.1 Domestic coal consumption versus coal exports

Coal continues to become increasingly important to Indonesia's domestic energy mix. There is some concern in government over the finite nature of Indonesia's coal reserves and the prospect that they may dwindle in the face of rapidly growing extraction. One recent planning scenario would maintain future coal production roughly at the present level (~400 Mt/yr) and, over time, would direct more of that coal production towards domestic consumption (and conversely, less towards export).

At least part of this planning scenario seems to be rooted in a desire or preference to export value-added products rather than raw materials.

Some coal industry representatives question the government's concern over the finiteness of coal reserves, believing instead that additional coal resources can be found and/or more coal resources can be converted to coal reserves in the future. That said, Indonesian officials cite the country's limited coal reserves as a potentially major constraint on their nationwide energy plans, which do not allow for coal imports of any significance. Their planning activities are further complicated by the extent to which coal exports are fuelling Indonesia's economy. Coal exports have become important in topics ranging from Indonesian employment to foreign relations with neighbouring countries that rely upon those exports.

ENVIRONMENTAL PROTECTION

Indonesia's legal infrastructure and supervisory mechanisms have failed to keep up with the rapid expansion of its mining sector. As most permits were issued without sufficient due process, a large number went against the interests of the public. Over 99% of Indonesia's coal is surface mined, thus affecting large areas of forested and agricultural land, adding to land-based carbon dioxide (CO_2) emissions. On the island of Kalimantan, Indonesia's coal mining centre, open-pit mines lie within or directly next to tropical rainforests and farmers' rice fields. Coal mining leads to the degradation of farmland, wetlands, streams and forested lands. Water discharged from coal mines is often

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contaminated with heavy metals, salts and solids, and has either high alkalinity or acidity and adds to water pollution, potentially harming fisheries, agriculture and people using the water. Indonesian coal mines have been found in breach of adequate monitoring and treatment of their discharges, making the impacts worse.

In addition, coal loading and transport operations spread coal dust into their surroundings. Coal loading in East Kalimantan sometimes takes place in the middle of villages, where humans are exposed to coal dust pollution. More than a million people along the Mahakam River are potentially exposed to coal dust blown off the uncovered coal barges sailing down the river every day. Small-scale and illegal mining operations that do not have the means to invest in adequate loading facilities, water catchment and treatment or other requirements, are a considerable part of the problem.

The National Audit Bureau (BPK) as well as the Anti-Corruption Commission (KPK) confirmed flaws in concessions, royalty payments, environment and forest protection, and the establishment of reserve funds. An audit carried out by the BPK found that Indonesia's forests have been exploited beyond their ability to regenerate. The audit attributed this to: the conversion of land into palm oil plantations and mining zones; the lack of clear boundaries for forest areas; and the lack of co-ordination between central and local governments in managing concessions.

The use of coal in the energy mix has also experienced strong growth over the past decade. As such, the share of coal in emissions has increased from 18.8% in 2000 to 30.6% in 2011. The planned rapid expansion of coal-fired power generation and industry threatens to worsen carbon emissions and local air quality, further conflicting with Indonesia's greenhouse gas emissions goals. The Central Java power plant, for example, will release 16 000 tonnes of sulphur oxides (SO_x), 20 000 tonnes of nitrogen oxides (NO_x), over 600 tonnes of particulates and over 200 kilogrammes of mercury every year. The ten-year plan for electricity projects envisages coal-fired power generation increasing by over 160% between 2013 and 2022. Critical and super-critical coal-fired power plants and retrofitting helps lower the emissions substantially, while ensuring reliable electricity supplies.

INSTITUTIONS

The Ministry of Energy and Mineral Resources (MEMR) has a Directorate-General of Mineral and Coal (DGMC), which is the principal institution for the formulation of policies and regulations concerning coal mining. The directorate has been restructured since 2008, as geothermal energy is now under the control of the Directorate-General for New and Renewable Energy, and Energy Conservation. To obtain a concession to explore and develop a medium-scale or large-scale mine in Indonesia, a company must apply for and receive a mining business permit (IUP) or a special mining business permit (IUPK) from ESDM. The DGMC is also responsible for ensuring that the coal required by coal-fired power plants will be available in a timely manner and that the transport facilities for moving the coal from the mine to the power stations are in place. The DGMC co-ordinates this with the Ministry of Transport, the Ministry of Home Affairs, and local governments.

The Ministry of Forests is involved in the concession approval process if the concession area is located in an area specified as forest area. Given that about 70% of Indonesia's land is designated as forest, and almost all mining areas are located in forest areas, the

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Ministry of Forestry holds a key role in the concession process, which is specified in the Law on Forestry 41/1999.

The Ministry of Environment needs to approve the environmental permits that mining companies are required to obtain before a concession or licence is approved. In this regard, the ministry ensures that companies issue an Environmental Management Statement, Environmental Management Efforts/Environmental Monitoring Efforts Reports or an Environmental Impact Assessment (AMDAL),[3] depending on their industry and exposure to the environment. All mining activity requires an AMDAL.

Regional and local governments are involved via the legislation for regional autonomy, Law No. 32/2004, which mandated a transfer of permitting and oversight of mining activities from MEMR to provincial and district governments. The functions of environmental monitoring were also largely transferred. Royalties are paid in part to the provincial and district governments. The 2009 law further increased regional governments' rights. They make the initial decision, for example, on the granting of mining concessions, whereas the central government reviews these concessions subsequently.

GOVERNMENT POLICIES AND PROGRAMMES

THE MINERAL AND COAL MINING LAW

In 2009, the government of Indonesia issued the Law on Mineral and Coal Mining, replacing its 1967 framework for mining as recommended by the previous *Energy Policy Review of Indonesia* (IEA, 2008). The 2009 law changed the contracting and licensing process, introduced the designation of mining areas, recognised 100% foreign investment (with a divestment policy which, due to the limited number of foreign players in the coal sector, is of low significance), initiated a tender process, designated the utilisation of local content, and started a ban on raw material exports and a value-added policy.

Under the new licensing regime, each level of government can issue a mining business permit (IUP) or a special mining business permit (IUPK). Unlike the previous Coal Contracts of Work (CCoW) arrangements that combined the licenses for all stages in mining business cycles, the current mining licence (IUP or IUPK) is granted in two separate phases: exploration and production operations. The exploration IUP/IUPK is for conducting general survey, exploration and feasibility studies within the authorised mining areas. The production IUP/IUPK is for construction, mining, processing, refining, hauling and selling within the authorised mining areas. Under the IUP system, companies may acquire larger areas, but on reduced terms. The maximum area allowed under an IUP has been significantly increased. Coal IUPs can be up to 50 000 hectares (Ha) and 15 000 Ha for exploration and production phases, respectively. However, the term of production-phase IUPs has been reduced to 20 years, with the possibility of two 10-year extensions. The predecessor production licence was for 30 years, with two 10-year extensions. The old CCoWs were allowed to endure until renegotiation, which is currently under way.

The new law stipulates that mining is only permitted in mining areas designated by central government in consultation with the Parliament and regional governments. This

3. Official Indonesian abbreviation.

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changed in 2012, when the Constitutional Court decided that the regional governments have the first right to determine areas under their jurisdiction to be designated as mining areas. Central government will then consider these for final approval.

The 2009 law also allows central government to set production quotas for coal mining for each province. Local government must comply with production quantities. Enforcement, however, is difficult as demonstrated by the estimates for illegal mining. Indonesia currently aims to cap coal production at 400 Mt per year. As a follow-up to 2009 law, MEMR issued a ministerial order that introduced a Domestic Market Obligation (DMO). Since 2011, coal mining companies are required to sell 24.17% of their output to the domestic market.

In 2011 and 2012, the government introduced a number of regulations to clarify the general stipulations of the law. The most relevant change for the coal sector is the opening of renegotiation of contracts to bring them into line with the stipulations of the Law on Mineral and Coal Mining, in particular regarding the size of mining areas, contract extensions, royalties and tax provisions.

With respect to coal, Indonesia's government indicated its intention to ban low-calorific coal exports under the ban on raw material exports and the value-added policy. MEMR circulated a draft regulation on value-added upgrading of coal through processing and refining activities. Under the draft regulation, coal with a calorific value of 5 700 kilocalories per kilogramme or less, on an air-dried basis, will be banned from export once the new government and Parliament approve the regulation.

THE NATIONAL ENERGY POLICY

The National Energy Policy estimates Indonesia's domestic coal need to rise from 62 million tonnes of coal equivalent (Mtce) in 2015 to 120 Mtce in 2020, and 163 Mtce in 2025. It also articulates that Indonesia should redirect coal to the domestic market, first capping future coal production at approximately 400 Mt per year and, over time, increasingly direct coal production towards domestic consumption, eventually phasing out exports.

Indonesia aims to establish a regulated market for coal domestically, but continues the current practice of setting the domestic coal price until a market mechanism has been established.

In addition, the National Energy Policy proposes the use of coal as a backbone to national energy supply and electricity production, and aims to increase the use of medium- and high-grade coal in domestic power plants, with low-grade coal used for mine-mouth power plant, as gaseous coal and for the liquefaction of coal.

THE FOREST MORATORIUM

In May 2011, the government introduced a two-year moratorium on new licences in peatland and primary natural forest. The forest conservation moratorium is one of several commitments made by the President in support of a bilateral agreement with Norway, under which Norway has pledged up to USD 1 billion for Indonesia to reduce greenhouse gas emissions under the REDD+ programme. Certain exemptions under this Presidential Instruction include those for companies that have already received a forest use permit at the production stage, or have successfully applied to extend an existing permit.

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BPK AUDIT

The BPK audit of the mining sector revealed that the Ministry of Energy's internal control systems had not been able to effectively ensure the achievement of goals and compliance with the laws and regulations in the seven districts examined. These control systems relate to the management of coal mining permits, non-tax revenues, and environmental management of coal mining. The BPK found that the state had lost approximately USD 24.27 million or IDR 315.67 billion in state revenue from the entire mining sector during 2011/12.

Reclamation and/or post-mining plans or guarantees had not been submitted in many cases, which meant there was no assurance that any potential environmental damage would be addressed. As the Minister of Energy and Mineral Resources had yet to issue the required regulations on administrative procedures for imposing sanctions or for the supervision of mineral and coal mine management, implementation was found to be lax. Only 41% of the 10 235 listed mining companies were adjudged clean and clear as of 1 March 2012.

In the second semester of the 2013 audit of mining and minerals management, BPK found irregularities in the payment of royalties and dues. The audit was conducted on 64 holders of metallic mineral and coal mining permits, 2 CCoW contractors, and 6 coal concession companies. The lack of royalty payment has been going on for years. Data from the Ministry of Energy shows that coal royalty arrears from 2006 to 2013 reached IDR 1.3 trillion. If in the next six months the companies fail to pay, the government plans to bring the case to the criminal court (BPK, 2012).

ASSESSMENT

Indonesia's coal industry and related policy have made large strides over the past decade, in which coal production more than doubled. The coal industry is an important part of Indonesia's national economy, providing export and royalty revenues to central and provincial governments.

Indonesia is to be commended for having made significant progress in following the recommendation of the previous *Energy Policy Review of Indonesia* (IEA, 2008) to implement the 2009 Law on Minerals and Coal. The 2009 law, however, is still in its initial implementation phase and the government needs to step up its regulatory efforts to fully implement and enforce its stipulations. The renegotiation of contracts, the establishment of mine rehabilitation funds, the correct payment of royalties and the correct demarcation of mining concessions are collectively of utmost importance to ensure the sustainable governance of Indonesia's coal mining sector.

The government of Indonesia is to be commended for having taking action to protect forests by means of the Forest Moratorium, limiting mining activities in protected areas. Together with the provisions on environmental safeguards, the government has at its hand the tools to ensure sustainable coal mining, but it must use these tools to enforce the rules. This requires that enforcement officers are adequately trained in the rules, and that regulations to hold trespassers to account are finally issued by the government.

One of the challenges in Indonesia's decentralised environment is the overlapping of responsibilities between central, regional and local governments and various ministries. A clear and transparent separation of powers and responsibilities is needed, with clear

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reporting lines and decision making to improve the governance and oversight of the coal mining sector. A starting point to secure a clearer picture of the Indonesian coal mining sector would be the establishment of a reliable and comprehensive database on coal concessions, coal production and coal trading. This would enable the government to make better-informed decisions about its coal policies.

Because coal is a natural resource that belongs to the Indonesian people, illegal mining activity needs to be reined in, to ensure safety, environmental, royalty and tax compliance by those involved.

Indonesia's aim to redirect coal to the domestic market will require improvements in infrastructure. Rail projects could help decrease the dangers to road safety and health stemming from open truck transport. Better regulations of barge transport could also help decrease health dangers.

Indonesia needs to balance its energy security concerns and its focus on coal, with its greenhouse gas emission reduction goals. It will be very difficult to increase electricity production from coal further and still reach the proposed emission reduction targets in the energy sector.

Finally, the recent changes to the regulatory framework for companies, including the proposed production cap, the increases in royalties, the low-grade coal export ban and the rule on foreign ownership divestment, are serious changes to the business framework in the coal sector. Indonesia needs to finalise the implementation of the 2009 law and establish a clear, reliable and enduring framework for coal mining companies.

RECOMMENDATIONS

The government of Indonesia should:

- *Fully implement the 2009 Mining Law and enforce legal and regulatory stipulations to ensure environmental, royalty and tax compliance by coal mining companies. Increase the number of, and training for, coal mine inspectors.*
- *Step up efforts to regularise semi-legal mining and work with local and provincial authorities to prevent and sanction illegal mining, so all mining activities are subject to appropriate regulations.*
- *Require coal producers and users to report data periodically to PUSDATIN, empowering it to gather, analyse and disseminate pertinent energy data, upon which more precise energy policies can be predicated.*
- *Prioritise transport infrastructure projects that will bring coal to markets safely, such as accelerating Indonesia's road-to-rail initiative, building investor partnerships where possible.*

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6. CLIMATE CHANGE AND ENVIRONMENT

Key data (2012)

CO_2 emissions from fuel combustion: 435.5 Mt (25% of total), +46.5% since 2002

Emissions by source: oil 53.1%, coal 28.6%, natural gas 18.3%

Emissions by sector: power generation 36.4%, transport 29.5%, industry 21.6%, other energy industries 5.7%, residential 4%, commercial 2.8%

Carbon intensity: 0.22 tCO_2/USD 1 000 PPP (IEA average: 0.31 tCO_2/USD 1 000 PPP), -15.8% since 2002

OVERVIEW

BACKGROUND

Indonesia covers one of the richest areas of biodiversity in the world and contains the most extensive standing rainforests in Asia, with an estimated 94 million hectares (232 million acres) of forest cover – an area the size of Nigeria. Indonesia's environment, however, is at risk.

In a similar way to many other countries, the economic development of Indonesia has gone hand-in-hand with deforestation. In particular the extension of plantations, agriculture and extractive industries has had a significant impact on forest cover, biodiversity and pollution levels. Natural and man-made forest fires have exacerbated the problem and spread haze and particles within and across Indonesia's borders. Since 1990, Indonesia has lost nearly a quarter of its forests and, at current rates, could lose all remaining forests during this century.

Indonesia was the world's sixth-largest emitter of carbon dioxide (CO_2) in 2012, accounting for 4.5% of global emissions. Energy-related emissions make up 25% of total CO_2 emissions, of which 42.1% comes from the power generation, 21.6% comes from industry, 29.5% comes from transport, and 6.8% comes from residential and commercial sectors. Moreover, energy-related emissions are rising fast and are projected to increase further in line with Indonesia's high economic growth rate. The remaining CO_2 emissions derive from deforestation and land-use change, including those from the destruction of Indonesia's peatlands, which store globally significant carbon stocks.

As a tropical archipelago with an extensive coastline and significant dependence on agriculture and natural resources, Indonesia is highly vulnerable to the effects of climate change. The Asian Development Bank estimated that the economy-wide cost of climate change in Indonesia could reach between 2.5% and 7% of gross domestic product (GDP) by 2100. This always raises questions about the resilience of Indonesia's energy infrastructure to more frequent and more intense weather-related disasters such as floods, storms, and sea-level rise.

The energy and resource extraction sectors are having an increasingly negative impact on Indonesia's environment. Examples include the environmental damage caused by

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extractive industries, local air pollution from fossil fuel combustion, water pollution from hazardous waste, as well as the rising contribution of fossil fuels to Indonesia's globally significant greenhouse gas (GHG) emissions. The energy industry also makes substantial use of the shoreline and coastal waters for terminals, shipping and cooling water, endangering marine habitats.

Indonesia today faces a dilemma – how to balance the development of its economy and the extraction of natural resources and increasing energy demand with rising GHG emissions, worsening air pollution, and the loss of the significant natural capital and ecosystem services provided by its forests and their underlying biodiversity. The awareness of the Indonesian population and the government of the importance of sustainable development and environmental protection has increased, in particular regarding water pollution, floods, droughts, urban air quality, forest degradation, illegal logging and fires.

ENVIRONMENT AND GHG TARGETS

Indonesia has emerged as a leading proponent of climate change action and is highly engaged in the global political negotiations. It is Party to the United Nations Framework Convention on Climate Change (UNFCCC) and to the Kyoto Protocol. It ratified the Kyoto Protocol in 2004 and has been an active participant in the Clean Development Mechanism (CDM). Having hosted the Bali Climate Change Conference in 2007, Indonesia submitted its 2nd National Communication to the UNFCCC in November 2010 (Ministry of Environment, 2010).

Table 6.1 Targeted emission reductions per sector

Sector	Emissions reduction target ($MtCO_2$)		Activities
	Unilateral	Supported	
Forestry and peatland	672	1 039	Forest and land fire control, network system management and water management, forestry and land rehabilitation, industrial plantation forest, community forest, illegal logging eradication, deforestation prevention, community empowerment.
Agriculture	8	11	Introduction of low-emission paddy varieties, irrigation water efficiency, organic fertiliser use, land-use optimisation, waste utilisation.
Energy and transport	38	56	Biofuel use, engines with higher fuel efficiency standards, improvement in transport demand management, quality improvement in public transport and roads, demand-side management, energy efficiency, renewable energy development, post-mining replanting.
Industry	1	5	Process modification and clean technology implementation, energy management in energy-intensive industries e.g. cement, ozone-depleting substances eradication.
Waste	48	78	Waste management and urban integrated waste water management.
Total	**767**	**1 189**	

Source: NCCC (2013), *Market Readiness Proposal: Indonesia*, National Climate Change Council, Jakarta.

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Indonesia is a Party to the Convention on Biological Diversity and is a signatory[1] of the ASEAN Agreement on Trans-boundary Haze Pollution, which commits the country to preventing, reducing and controlling trans-boundary environmental harm, including from fires linked to deforestation. In 2009 at the G20 Summit in Pittsburgh, Indonesia announced a voluntary emissions reduction target of 26% by 2020 against a business-as-usual scenario and up to 41% with international assistance.

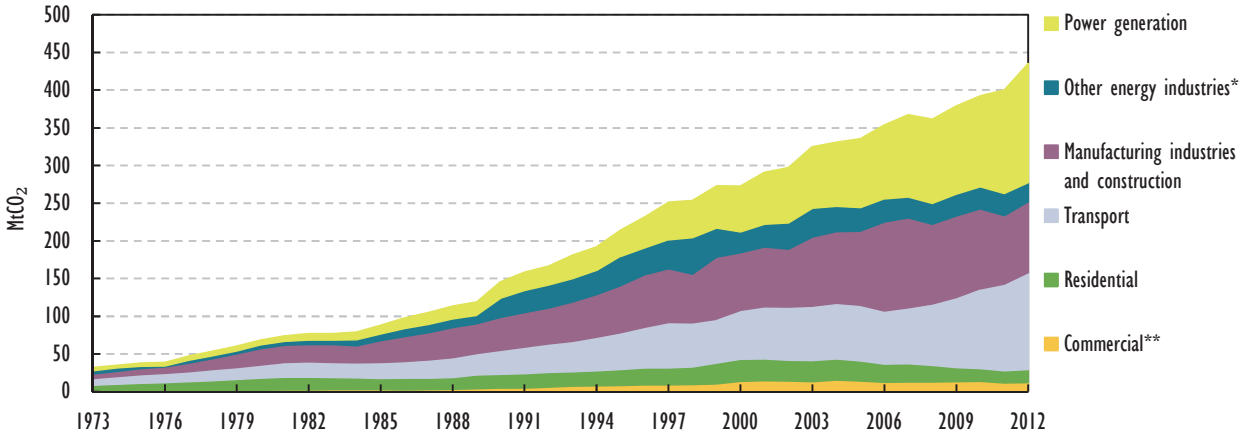
The reduction targets would amount to 767 million tonnes of carbon dioxide ($MtCO_2$) and an additional 477 $MtCO_2$ respectively under the National Action Plan for Reducing Greenhouse Gas Emissions. Indonesia plans to achieve these targets via a series of reductions across five sectors (see Table 6.1 above).

ENERGY-RELATED CO_2 EMISSIONS

SOURCES OF CO_2 EMISSIONS

Indonesia's CO_2 emissions from fuel combustion amounted to 435.5 million tonnes (Mt) in 2012 (Figure 6.1). This is a 46.5% increase compared to 2002 and 198.2% higher than in 1990. Emissions of CO_2 have been increasing steadily for decades due to energy-related development and expansion.

Figure 6.1 CO_2 emissions by sector, 1973-2012



* *Other energy industries* include other transformations and energy own-use.

** *Commercial* includes commercial and public services, agriculture, fishing and forestry.

Source: IEA (2014), *CO_2 Emissions from Fuel Combustion*, OECD/IEA, Paris.

The power generation sector is the largest CO_2 emitter; it accounted for 36.4% of all energy-related emissions in 2012. It is also the sector that has experienced the strongest growth in emissions since 2002, growing by 8% per year. The planned rapid expansion of coal-fired power and industry threatens to worsen local air quality further. The Central Java power plant, for example, is projected to release 16 000 tonnes (t) of sulphur oxides (SO_x), 20 000 t of nitrogen oxides (NO_x), over 600 t of particulates and over 200 kilogrammes (kg) of mercury every year.

1. Indonesia signed this treaty in 2002 but has yet to ratify it.

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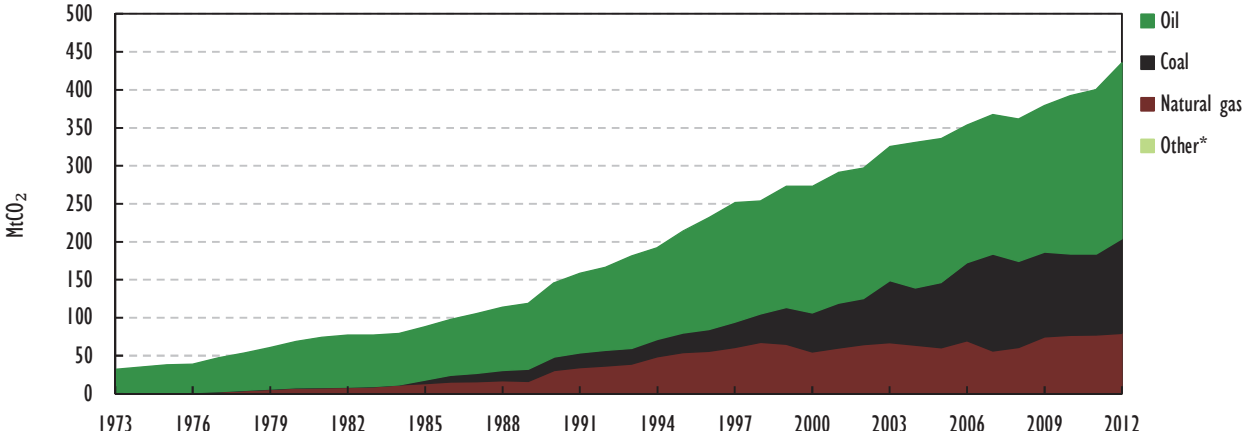
Emissions from transport and industry represented 29.5% and 21.6% of total CO_2 emissions in 2012, respectively. Both sectors have increased emissions since 2002, up by 6.2% per year in transport and 2.1% per year in industry.

The residential and commercial sectors together with other energy industries, which include processes other than power generation, together account for 12.5% of energy-related CO_2 emissions.

Emissions in the residential sector have been in decline for a decade, falling at an annualised rate of 4.5% since 2002. Emissions in the commercial sector and other energy industries have also declined over the same period, albeit at slower rates of 1.7% and 3.3% per year, respectively.

Around 53% of CO_2 emissions from fuel combustion are from oil, with the remainder from coal (28.6%) and natural gas (18.3%). The use of coal in the energy mix has experienced strong growth over the past decade, with its share of emissions increasing from 20.5% in 2002 to 28.6% in 2012, while oil's share has fallen from 57.7% to 53.1%. The share of natural gas has also contracted, from 21.8% to 18.3% (Figure 6.2).

Figure 6.2 CO_2 emissions by source, 1973-2012



* *Other* includes industrial waste and non-renewable waste.

Source: IEA (2014), *CO_2 Emissions from Fuel Combustion*, OECD/IEA, Paris.

Carbon intensity

In 2012, Indonesia emitted 0.23 t of CO_2 per USD 1 000 at purchasing power parity of GDP (tCO_2/USD 1 000 PPP). This is lower than the IEA member country average of 0.31 tCO_2/USD 1 000 PPP.

Compared to IEA member countries, Indonesia ranks sixth-lowest with regard to carbon intensity – higher than Austria, France, Norway, Sweden and Switzerland.

Carbon intensity in Indonesia was on an increasing trend for decades before reaching a peak of 0.28 tCO_2/USD 1 000 PPP in 2003. Since 2002, intensity has decreased by a total of 15.8%, while the IEA average intensity has decreased by 19.1% (Figure 6.3).

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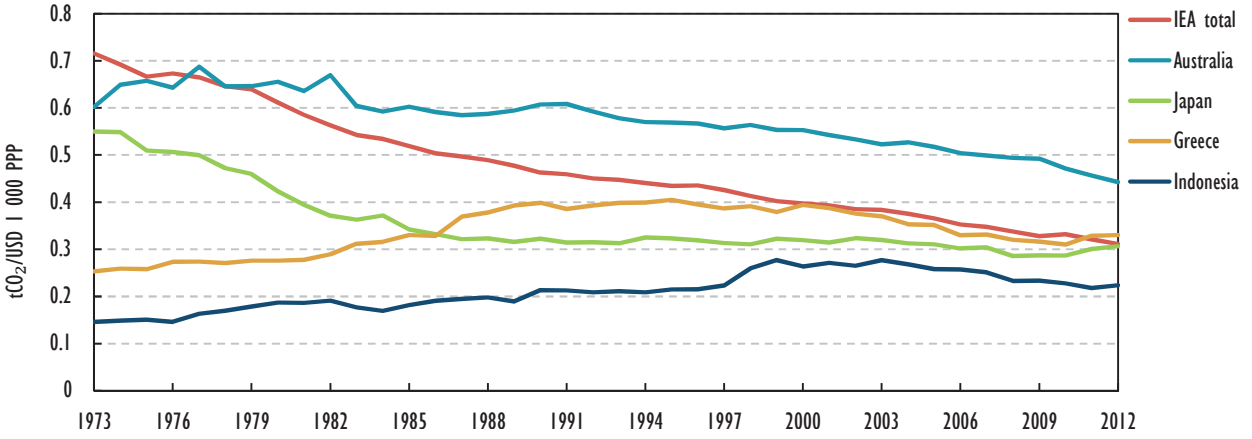
Figure 6.3 Carbon intensity in Indonesia and in selected IEA member countries, 1973-2012



Source: IEA (2014), *CO_2 Emissions from Fuel Combustion*, OECD/IEA, Paris.

MINING

Almost all mining deposits in Indonesia are located within forested areas, many of which are classified as protected rainforests. Coal mining uses large areas of forested land, contributing to land-based CO_2 emissions. On the island of Kalimantan, Indonesia's major coal mining centre, open-pit mines often lie within or directly next to forests and farmers' fields. Coal mining leads to the destruction of farmland, wetlands, streams and forested lands and is a major source of water pollution. Water discharged from coal mines is often contaminated with heavy metals, salts and solids and has either high alkalinity or acidity. All of these pollutants can harm fisheries, agriculture and people using the water. Indonesian coal mines do not adequately monitor and treat their discharges, worsening the impacts.

Coal loading and transport operations spread toxic coal dust into their surroundings. Coal loading in East Kalimantan, for example, sometimes takes place in the middle of villages, where children and adults are exposed to health-threatening levels of coal dust pollution. More than a million people along the Mahakam River are potentially exposed to coal dust blown off the numerous large, uncovered coal barges sailing down the river every day. Small-scale and illegal mining operations that do not have the means to install modern loading facilities, water catchment and treatment, and other infrastructure, are a considerable part of the problem (Greenpeace Indonesia, 2014).

INSTITUTIONS

The Ministry of Environment was established in 1973 and is responsible for environmental policy and planning. The ministry co-ordinates policy implementation, provides technical guidance, and supervises environmental management of sectoral ministries and provincial environment authorities. It is also responsible for the implementation of climate change policies. In addition to its co-ordinating function, it has direct regulatory authority over hazardous waste facilities and disposal.

The Ministry of National Development Planning (BAPPENAS) is in charge of medium- and long-term national development planning and the integration of environmental and climate change policy into national economic planning. To this end, BAPPENAS

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established a National Co-ordination Team on Climate Change that advises on the implementation of the National Action Plans related to climate change, and co-ordinates between central and provincial level planning and implementation. The Secretariat for the National Action Plan to Reduce Greenhouse Gas Emissions assists the Climate Change Co-ordination Team in BAPPENAS and the sectoral mitigation working groups and local government bodies in planning, monitoring and implementation of GHG emissions reduction actions under the National Action Plan.

The National Council on Climate Change (NCCC) was established in 2008 to co-ordinate Indonesia's climate change policies and measures. The NCCC includes the key ministries involved in climate change mitigation and adaptation in Indonesia, namely, the Co-ordinating Ministry for People's Welfare, the Co-ordinating Ministry for Economic Affairs, the Ministry of Environment, the Ministry of Finance, the Ministry of Energy and Mineral Resources, the Ministry of Forestry, the Ministry of Agriculture, the Ministry of Industry, the Ministry of Public Works, BAPPENAS, the Ministry of Maritime Affairs and Fisheries, the Ministry of Trade, the Ministry for Research and Technology and the Ministry of Health. In addition, the Cabinet Secretariat and the Agency for Meteorology and Geophysics are included.

The Ministry of Forestry is responsible for all activities related to areas designated as forest in Indonesia. It is involved in approving land concessions for palm oil plantations and resource extraction and drilling activities. A Presidential Decree also established an agency that is empowered to approve all projects relating to REDD (Reducing Emissions from Deforestation and Forest Degradation), giving the Ministry of Forestry a considerable role in Indonesia's climate change reduction activities.

The Ministry of Energy and Mineral Resources (MEMR) is the principal actor in the governance of the energy and mining sectors. It is responsible for formulating national policies to guarantee energy security and minerals supply in an equitable and sustainable way, and for carrying out research and development in the energy and mineral resources sectors. It manages properties, submits evaluation reports and advises the President on tasks that lie within its responsibility.

POLICIES AND MEASURES

OVERVIEW

Climate change and environmental protection are important topics for the government of Indonesia. Indonesia strengthened its legal basis for environmental protection and enforcement measures considerably with the 2009 Environment Law, which also includes climate change policies and measures.

Since then, the Ministries of Environment and of Forestry have become more stringent in granting new mining licences in forested areas, and mining activities (especially open-pit mining) are more likely to be banned within protected forests, due to the advocacy of NGOs such as WALHI and JATAM. The short-lived 1999 ban on mining in protected areas may also be reinstated. MEMR has developed mining good practice to be implemented by mining companies operating in forestry areas.

On climate change, the government has emerged as a global leader following the 2007 Bali Conference and issued its first broad-based National Action Plan for Climate Change in 2007, which was followed by two separate and more concrete Action Plans for

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mitigation and adaptation measures in 2011. Indonesia is currently working on a national GHG inventory, as well as sectoral implementation plans, to achieve the targeted emissions reductions. As part of these plans, the government aims to change Indonesia's large forested area from a net carbon emitter to a carbon sink.

ENVIRONMENTAL LAW

Indonesia issued an updated Environmental Law in 2009. The law deals with environmental protection and degradation issues, as well as climate change mitigation. The Ministry of Environment is the focal point for the implementation and co-ordination of the policy measures under the law.

The Environmental Law requires companies to issue an Environmental Management Statement, an Environmental Management Efforts-Environmental Monitoring Efforts Report or an Environmental Impact Assessment (AMDAL) depending on their industry and exposure to the environment. All mining activity requires an AMDAL. In addition, the law provides a new requirement for companies to carry out an environmental risk analysis and obtain an environmental permit for mining operations. The latter is a precondition for obtaining other business permits. The law also requires the owner of an environmental permit to provide a guarantee fund that will be used to rehabilitate their work site in the event of environmental damage or restoration.

The law now also requires that companies perform environmental audits. Under Article 121, paragraph 1, of the Environmental Law, existing companies with no AMDAL needed to complete environmental audits within two years of the enactment of the law, i.e. by 3 October 2011. According to the current Ministry of Environment draft Government Regulation on Environmental Audits, this obligation will also apply to companies with no environmental management and monitoring system (known as UKL-UPL). In addition, those companies without UKL-UPL must also formulate an environmental management document within the two-year timeframe.

The 2009 Environmental Law has stronger administrative and criminal penalties than previous legislation. It provides more rights to government institutions, local governments, civil society and environmental non-governmental organisations concerning environmental pollution or damage. The law still imposes strict liability on companies that use dangerous and hazardous material, produce and/or manage hazardous waste and cause serious threat to the environment. It also imposes penalties on government officials who grant environmental permits without following the proper procedures.

NATIONAL ACTION PLAN TO REDUCE GREENHOUSE GAS EMISSIONS (NAPRGG)

The National Action Plan to Reduce Greenhouse Gas Emissions (NAPRGG) was introduced in September 2011. The NAPRGG sets sectoral allocations for achieving the reduction targets (see above) and establishes the framework for all provinces to develop provincial action plans. BAPPENAS has been appointed as co-ordinator for this process, and has issued guidelines for the implementation of the NAPRGG at national and sub-national level. The Nationally Appropriate Mitigation Actions (NAMAs) within this action plan will be prepared taking into account the national development principles and priorities, the mitigation potential and feasibility within each sector, and the financial sources necessary for implementation (BAPPENAS, 2011).

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NUSANTARA CARBON SCHEME (NCS)

Indonesia has initiated a voluntary emissions reduction certification and registration scheme – the Nusantara Carbon Scheme (NCS). The NCS facilitates the development of a domestic carbon market and encourages local companies to reduce their emissions voluntarily. The scheme is still in its early stage and more input is needed to bring it into full operation. Operationally, the NCS is comparable to the CDM with which Indonesia has ample experience. For the time being, NCS is open to Indonesian entities only and relies on voluntary demand despite its uncertainty in volume. As a longer-term vision, NCS could also be used as offset provider for implementation of any GHG limitation policies adopted by the government. It could also be used as a trading and/or linking tool with other market mechanisms that recognise the NCS as compatible.

JOINT CARBON MECHANISM (JCM)

In 2013, Indonesia and Japan signed an agreement to embark on a new carbon trading scheme, the Joint Carbon Mechanism (JCM). The JCM is intended to incentivise clean technology co-operation between the two countries. The eligible projects can be of various types, including REDD+, carbon capture and storage (CCS), agriculture, energy efficiency, peatland management, renewable energy and maritime transport. Around 75 feasibility studies have been carried out so far, and a number of demonstration projects are under way, covering supply-side and demand-side energy sectors (Indonesia JCM Secretariat, 2014).

REDUCING EMISSIONS FROM DEFORESTATION AND FOREST DEGRADATION (REDD)

Indonesia participates in the REDD and REDD+ programmes, which aim to create a financial value for stored carbon, arrest deforestation and forest degradation, enhance forest conservation, and support the sustainable management of forests and enhancement of forest carbon stocks. Given that Indonesia's GHG emissions are primarily land and forest based, this is a key programme to reach its goal of a 26% reduction in its CO_2 emissions.

In May 2011, as part of an agreement with Norway that pledged USD 1 billion for Indonesia's REDD+ programme, the government introduced a two-year moratorium on new mining licences in peatland and primary natural forest. The forest conservation moratorium included exemptions for companies that had already received a forest use permit at the production stage, or that successfully applied to extend an existing permit. For the coal mining, palm oil and geothermal industries, the moratorium is most likely to affect concessions located within forest areas.

INDONESIA CLIMATE CHANGE TRUST FUND (ICCTF)

The Indonesia Climate Change Trust Fund (ICCTF) was established in 2009 jointly by BAPPENAS and the Ministry of Finance to pool and co-ordinate national and international funds for Indonesia's climate change policies and programmes. The ICCTF prioritises projects in the energy, mining and forestry sectors for mitigation actions. The ICCTF has received about USD 11 million in funding so far, which will be fully spent by the end of 2014. The government is seeking further contributions to the ICCTF and ultimately sees it as a potential channel for funds flowing from the Green Climate Fund set up under the UNFCCC.

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MONITORING, REPORTING AND VERIFICATION

Indonesia is in the process of developing a credible monitoring, reporting and verification (MRV) system for climate-related measures. For the energy sector, general energy data consisting of energy balance and primary energy consumption (including solid and liquid fuel) are collected and published once a year by the Centre of Data and Information of MEMR (PUSDATIN). Based on primary energy consumption, PUSDATIN also calculates GHG emissions. For the power generation subsector, PUSDATIN calculates and annually updates grid emission factors using the CDM tool.

There are eight independent electricity grid systems in Indonesia, each of which has been assigned a grid emission factor. Data on electricity generation and fuel consumption for electricity generation are reported annually by the owners of power plants to the Directorate-General of Electricity (DGE). There is also a reporting mechanism from the power plants to PLN, the state-owned generation, transmission and distribution company. The audited electricity production data are submitted to the government for calculating the required electricity subsidy.

AIR POLLUTION

Indonesia is facing three distinct air pollution challenges in relation to indoor, local and regional cross-border air pollution. First, an estimated 103 million Indonesians (down from 180 million in 2004) still relied on biomass for cooking in 2011. This not only contributes to wider air pollution, but also poses serious health risks from indoor air pollution. The World Health Organization estimates that over 45 000 deaths per year are attributable to indoor air pollution in Indonesia (WHO, 2009).

Second, hand-in-hand with the rapid and ongoing urbanisation and economic growth, urban air pollution from fuel combustion is on the rise. Indonesia's big cities, such as Jakarta and Surabaya, are struggling to cope with air pollution from growing numbers of vehicles, construction projects, power plants and uncontrolled local incineration. By one estimate, residents of Jakarta get only 27 days of clean air each year. The Ministry of Environment estimated that air pollution in Jakarta alone caused economic losses of about IDR 3.8 billion due to increased mortality, treatment costs and loss of productivity.

The Ministry of Environment has conducted Urban Air Quality Evaluation as part of the Blue Sky Program and implementation of the programme on Environmentally Sustainable Transport (EST) (Blue Sky Program, 2011). Evaluations were undertaken in 2007, 2008 and 2011 using an established indicator and assessment system. The survey in 2011 found a number of urban areas with pollution indices exceeding guideline levels. Spot checks found that over 50% of diesel vehicles failed emission tests.

Third, forest fires spread haze and particles, frequently causing air pollution both within Indonesia and across the border in Malaysia and Singapore. The continuing high incidence of fires in Indonesia is a very serious political and environmental issue, and is often related to the clearing of land for major commodities, such as palm oil, pulp and paper, and to a lesser extent coal. Palm oil plantation owners, farmers and miners have been blamed for illegally starting Sumatran fires as a cheap method of clearing land, instead of mechanically cutting down trees.

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This damages forests and peatlands, contributes to air pollution and climate change and is severely detrimental to the health of people in the region. In 1997, forest fires blanketed Southeast Asia with smog for several months, causing billions of dollars in damage. There have been further episodes in 2002, 2005, 2013 and as recently as February 2014.

ASSESSMENT

Indonesia is to be complimented for the strengthening of its environmental legislation vis-à-vis the extractive industries, its intention to improve air quality and especially for its leadership on climate change mitigation and adaptation. The expenditure of coal mining companies on environmental protection reportedly went up by 14% from 2010 to 2011. However much remains to be done on the implementation, enforcement and co-ordination of existing policies (Indonesia Legal Consultants, 2012).

The effectiveness of Indonesia's climate change institutions remains a massive challenge for Indonesia (Angelsen et al., 2009). This particularly applies to the authority and co-ordination roles of the NCCC and the REDD Commission, co-ordination across government agencies and co-ordination between central, provincial and district governments.

Indonesia's energy-related emissions stand at around 445 $MtCO_2$, or approximately 20% of total GHG emissions. Transport and industry each contribute around 25%, and the power sector around 35% (according to 2011 data supplied by the Indonesian government). Emissions are increasing fast: current projections under government business-as-usual scenarios show emissions from energy rising to over 700 $MtCO_2$ by 2020.

In the government's NAPRGG, energy and transport together will contribute savings of 38 $MtCO_2$ by 2020, based on national actions alone, rising to 56 $MtCO_2$ with international support. This represents just 5% of overall savings, with the majority of savings coming from forestry and land-based sectors. The new National Energy Policy proposes an ambitious increase in renewable energy to 23% of primary energy by 2025. If achieved, this would deliver total savings of 94 $MtCO_2$ by 2020, comfortably exceeding the current NAPRGG targets, which are under revision.

Whereas the overall reduction appears highly ambitious, the mitigation target for the energy sector can be achieved only if Indonesia speeds up its implementation of renewable energies and the adoption of more efficient fuels. Indonesia has started to implement actions addressed at adaptation measures to ensure the resilience of its energy-related infrastructure.

Under the UNFCCC negotiations, countries are working towards a new climate agreement that will take effect from 2020 and be applicable to all countries. As part of this process, countries have been invited to communicate their "intended nationally determined contributions" towards the new agreement by the first quarter of 2015, if they are ready to do so. There will be pressure on all countries to demonstrate that what they propose is equitable and consistent with limiting global temperature rise to below 2°C. Like other countries, Indonesia will need to consider what actions it can take in the post-2020 period to reduce the carbon intensity of its energy sector, both unilaterally and with support. Indonesia could update existing low-carbon development strategies to accelerate the shift in energy sector emissions from growth to decline.

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The greatest energy-related emissions arise from vehicles and stationary combustion sources. Data on air quality are inconsistent, with limited monitoring and restricted long-term data series. A survey in 2011 found a number of urban areas with pollution indices exceeding guideline levels. Spot checks found that over 50% of diesel vehicles failed emission tests. Rising vehicle numbers will exacerbate this problem, while the planned rapid expansion of coal-fired power and industry threatens to worsen local air quality.

In the energy-related extractive industries, coal mining is the most environmentally damaging as a result of the relatively large land area affected. Opencast coal mining has multiple social and environmental impacts, including loss of land by surrounding communities, loss of forest cover with associated biodiversity and carbon impacts, and pollution of water bodies. Mining is exempt from the current moratorium on deforestation and continues to expand in forest areas. Almost 4 000 coal mining permits are currently in issue, of which over one-third (1 480) are not classified as “clean and clear”. Illegal coal mining is widespread, is by definition unregulated and has the most severe environmental impacts.

The Audit Board (BPK) found that environmental management control systems are not working and that government staff lack the training and capabilities to implement the complex set of laws related to mining concessions (BPK, 2012). Although prior environmental impact assessments (AMDAL) are required as part of the licensing of all mines, evidence suggests that their quality is variable, that they are not always undertaken, that affected communities rarely have sight of the AMDAL, and that enforcement of provisions such as post-mining reclamation is weak. Moreover, the 1999 Forest Law does not impose penalties on officials engaged in illegal activities, nor does it oblige the government to take legal action when companies or individuals destroy protected forests.

Water pollution both in riverbeds and coastal areas from chemicals, waste and residue from the oil, gas and petrochemicals industry continue to pose threats to humans and wildlife as supervision and enforcement remain weak.

The greatest threat to human health, however, is indoor air pollution from cooking with biomass, air pollution from forest burn and slash practices, and transport, causing a high number of premature deaths. The most high-profile air quality concern is the pollution caused by seasonal land clearance, resulting in widespread haze with national and international impacts as air quality in Indonesia and neighbouring countries reaches levels threatening human health in the wider region. This is not directly linked to energy, although biofuel,[2] coal and mineral demand are linked to pressure to expand mining concessions and palm plantations, which are a key driver of land clearance. A sensitive issue has been Indonesia’s secrecy in sharing maps and the exact location of the operations of companies with concessions in Sumatra, which could reveal whether, where, and which firms may be responsible for part of the haze.

Waste-to-energy technologies could also make a positive contribution, with GHG and wider environmental benefits. Yet implementation in Indonesia has proved to be

2. The category "Biofuels and waste" is an official statistical category that includes solid biofuels (commonly referred to as "solid biomass"), biogases, liquid biofuels, and the renewable portion of municipal waste (for more details see www.iea.org/statistics/resources/balancedefinitions/). This publication uses the term "biofuels for transport" for liquid fuels derived from organic material that are used as fuel in the transport sector, including biodiesel and ethanol.

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complex, requiring co-operation among many parties at municipal and national level. With a rising municipal solid waste problem, waste-to-energy technologies could play a significant role in Indonesia's green growth.

RECOMMENDATIONS

The government of Indonesia should:

- *Streamline responsibilities and institutions responsible for climate change action. There are currently too many actors involved, particularly on policy co-ordination. There should be clear delineation between the co-ordination role of the NCCC and the line ministries, which should take the lead for implementing such relevant measures. The NCCC working groups should deliver cross-ministerial co-ordination, rather than creating additional secretariats and commissions.*
- *Qualify the commendable emission mitigation targets of 26% and 41% with accurate baseline and business-as-usual case modelling, accompanied by realistic projections and forecasts of how targets are to be met across sectors including the possible impact of subsidy removal. Post-2020 targets should also be quantified against realistic business-as-usual projections.*
- *Step up efforts to regularise semi-legal mining and work with local/provincial authorities to control illegal mining, so all mining activities are subject to appropriate regulations; work with local government to improve enforcement of regulations covering mining, with a particular focus on improving the quality of environmental impact assessments (AMDAL), their public transparency, implementation and enforcement. It is essential to consult with and involve local communities in mining-related decisions.*
- *Strengthen vehicle emissions testing and sanctions for non-compliance, and increase the monitoring of local air quality.*
- *Establish a working group to support the implementation of waste-to-energy and facilitate co-ordination between (among others) the Ministry of Energy, Ministry of Public Works, national and municipal authorities, and planning authorities.*

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7. ELECTRICITY

Key data (2012)

Installed capacity: 45 253 MW

Total electricity generation: 195.9 TWh, +81% since 2002

Electricity generation by source: coal 48.7%, gas 23.2%, oil 16.7%, hydro 6.5%, geothermal 4.8%, biofuels[1] and renewable waste 0.1%

Consumption by sector: residential 41.5%, industry 34.6%, commercial 24.0%

Electricity per capita: 0.8 MWh (IEA average: 9.3 MWh)

OVERVIEW

BACKGROUND

Indonesia's fuel resources hold significant potential for electricity generation. The country benefits from considerable domestic coal, geothermal and hydropower availability, but faces significant challenges in realising this potential, given the archipelagic layout of its 17 000 islands. The country is encountering ongoing shortages in electricity supply, and is forecast to experience significant growth in power demand.

Since the last *Energy Policy Review of Indonesia* (IEA, 2008), the country has steadily increased its total installed capacity from around 29 500 megawatts (MW) in 2007 to approximately 46 400 MW in 2013. The expansion in installed capacity has helped contribute to an improved national electrification rate, which increased from around 65% in 2008 to just above 80% in 2013. Rural electrification, however, continues to face challenges, as most off-grid areas are in the outer ring of islands and located far from fuel sources. Indonesia's fuel mix for power generation has also seen a significant shift away from oil in recent years towards the utilisation of domestic coal resources, as the struggle to develop hydropower and geothermal power persists.

SUPPLY AND DEMAND

DEMAND

The residential sector is the main consumer of electricity in Indonesia, accounting for 41.5% of consumption in 2012. Industry represents 34.6% of consumption and the commercial sector accounts for the remaining 24%.

1. The category "Biofuels and waste" is an official statistical category that includes solid biofuels (commonly referred to as "solid biomass"), biogases, liquid biofuels, and the renewable portion of municipal waste (for more details, see www.iea.org/statistics/resources/balancedefinitions/). This publication uses the term "biofuels for transport" for liquid fuels derived from organic material that are used as fuel in the transport sector and includes biodiesel and ethanol.

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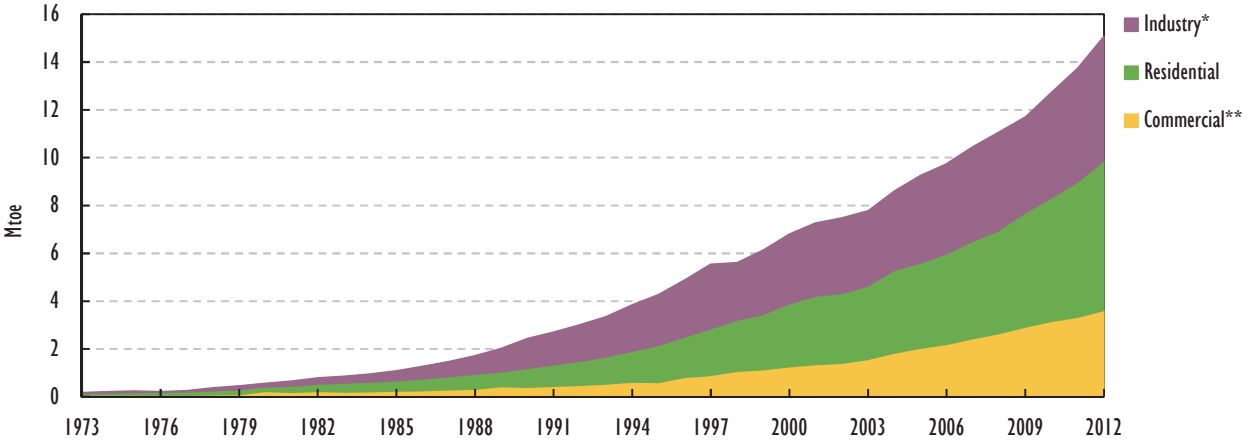
The commercial sector has experienced the strongest growth in demand for electricity over the decade to 2012, growing at 10% per year. Consumption in the residential sector has increased at an annualised rate of 7.9%, while industry growth was the slowest at 5.1% per year. Consequently, the share of industry in electricity consumption has fallen from 42.3% in 2002 to 34.6% in 2012. Conversely, the share of residential and commercial use has increased (Figure 7.1).

Figure 7.1 Electricity consumption by sector, 1973-2012



* *Industry* includes non-energy use.

** *Commercial* includes commercial and public services, agriculture, fishing and forestry.

Sources: IEA (2014a), *Energy Balances of Non-OECD Countries 2014*, OECD/IEA, Paris; country submission.

ELECTRICITY GENERATION

Electricity generation in Indonesia amounted to 195.9 terawatt hours (TWh) in 2012. This represents an increase of 6.8% compared to the prior year, and is 81% higher compared to 2002. Electricity production has been on a steady upward trend for decades, increasing at an annualised rate of 8.4% since 1990.

Fossil fuels account for 89% of total generation, a share which has increased somewhat from 85% in 2002. Approximately 49% of electricity comes from coal, with the remainder from gas (23.2%) and oil (16.7%). The use of coal in generation has more than doubled since 2002, increasing its share in electricity production from 39.7% in 2002 to 48.7% in 2012. Gas use has also nearly doubled. In comparison, the use of oil has decreased by around a half (Figure 7.2).

Renewable energy sources represent 11.4% of generation, made up mainly of hydropower (6.5%) and geothermal (4.8%). Electricity production from hydropower and geothermal has expanded over the ten years to 2012, although at a slower rate compared to the use of coal and gas. The proportion of hydropower production was a third higher in 2002 compared to 2012, while electricity from geothermal was a half higher.

Biofuels, waste, wind and solar sources of power generation exist; however, they remain at negligible levels compared to more established forms of generation. For example, the use of biofuels and waste in electricity generation expanded thirteen-fold in the ten years to 2012, although still accounted for only 0.1% of generation. In addition, wind and solar power were first introduced in Indonesia in 2009 and 2010, respectively, and together accounted for about 0.005% of generation in 2012.

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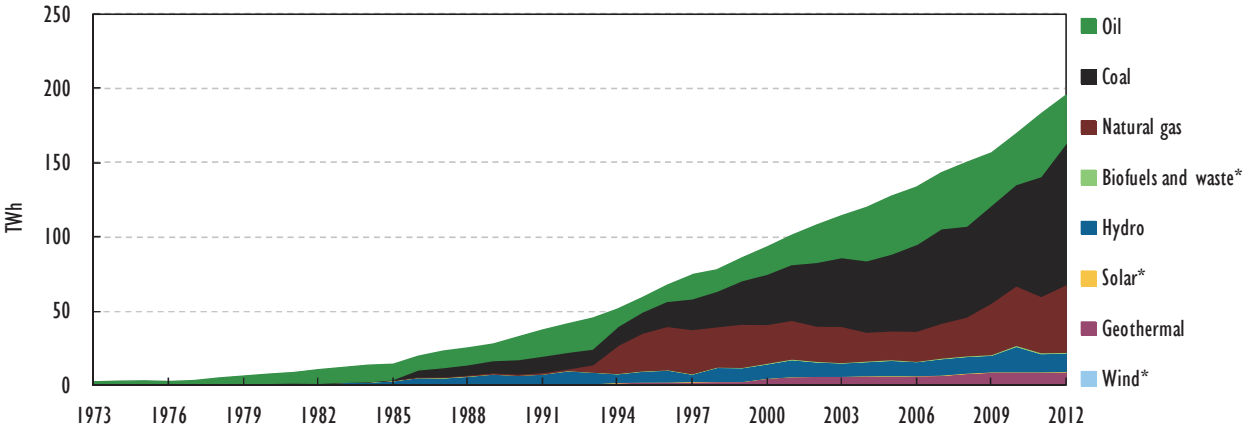
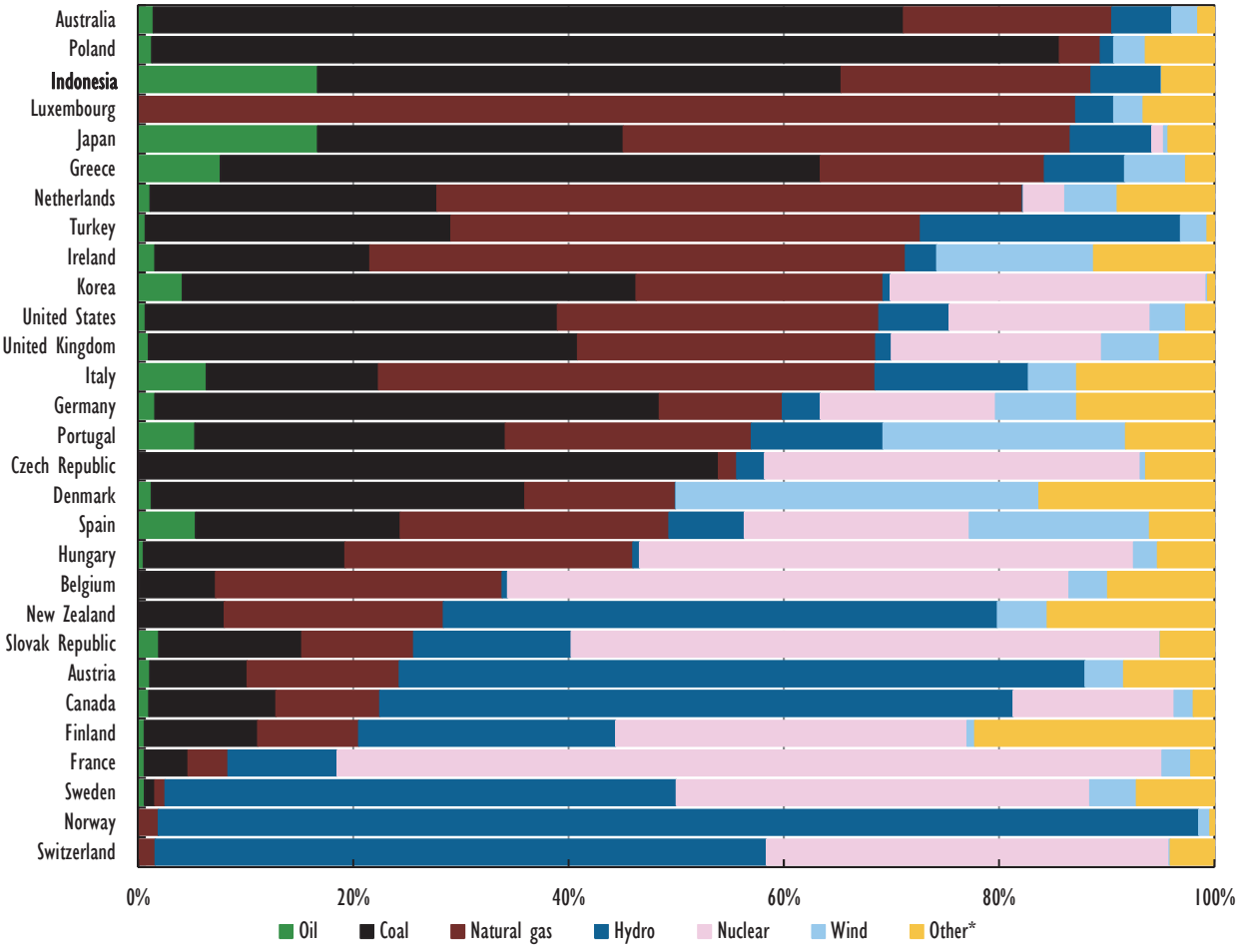
Figure 7.2 Electricity generation by source, 1973-2012



* Negligible.

Source: IEA (2014a), *Energy Balances of Non-OECD Countries 2014*, OECD/IEA, Paris.

Figure 7.3 Electricity generation by source in Indonesia and IEA member countries, 2012



* *Other* includes solar and geothermal.

Sources: IEA (2014a), *Energy Balances of Non-OECD Countries 2014*, OECD/IEA, Paris; IEA (2014b), *Energy Balances of OECD Countries 2014*, OECD/IEA Paris.

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Compared alongside IEA member countries, Indonesia ranks third highest with regard to the share of fossil fuels in electricity generation, behind Australia and Poland. It has the second highest share of oil use for generation, just below Japan. The use of geothermal energy in electricity is also high when compared with IEA member countries, second only to New Zealand in terms of share of electricity generation. Indonesia is the world's third-largest producer of geothermal electricity.

INSTITUTIONS

Electricity supply in Indonesia is controlled by the state and provided through the national and regional governments and state-owned enterprises.

PT Perusahaan Listrik Negara (PLN) is the vertically integrated state-owned utility, which is responsible for the management and development of generation, transmission and distribution in Indonesia. PLN controls nearly all distribution of electricity in the country and holds a near monopoly on transmission and distribution grids in its concession area. PLN also has the right of first refusal on all new generation capacity. PLN is owned by the state and supervised from a technical perspective by the **Ministry of Energy and Mineral Resources (MEMR)** and from a management perspective by the **Ministry of State-Owned Enterprises.**

The board and management of PLN report to the Minister of Energy and Mineral Resources, who gives final approval for power purchase agreements (PPAs) with independent power producers (IPPs), which are determined by PLN and follow guidelines established by the Directorate-General of Electricity. The **Directorate-General of Electricity** within MEMR oversees regulation, policy and planning with regard to electricity, in addition to the **Directorate-General of New and Renewable Energy** in the case of electricity provided by renewable fuel resources. There is no independent regulator or network operator in the electricity market.

Parliament is responsible for giving final approval to prices and subsidies in relation to consumer electricity tariffs as determined by the government.

The **Ministry of Finance** is responsible for guaranteeing the business feasibility of the Fast Track Projects Phases 1 and 2, and PPP (public private partnership) projects.

The **local and/or regional government** in its authority is responsible for approvals of local permits and environmental impact analyses, among other local requirements, as well as in some cases, the price of electricity, particularly in off-grid areas.

GOVERNMENT POLICIES

According to Indonesia's Electricity Law, the government's objective for electricity development is to ensure the availability of good quality electricity in sufficient quantity, and at reasonable prices in order to improve the welfare of the people. As such, domestic and foreign primary energy sources will be used optimally in accordance with the National Energy Policy to ensure a sustainable supply of electricity. Furthermore, government policy for the power sector specifies that the use of domestic energy sources will be prioritised in the national interest.

Electricity Law No. 15 of 1985 allowed for the initial, but limited participation of IPPs in the electricity generation market. This law was replaced by Electricity Law No. 20 of 2002, which allowed for greater private participation in the electricity sector. In addition,

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Electricity Law No. 20 introduced an independent market regulator through the establishment of the Electricity Market Supervisory Agency. The Constitutional Court, however, revoked this law in 2004 when the provisions for a competitive electricity market and unbundling of PLN were deemed unconstitutional. At the same time, Electricity Law No. 15 was re-instated. The view that the reforms were unconstitutional was based on the interpretation of the law that electricity is a public commodity and its generation and distribution should remain under the exclusive control of the government. As one of many factors, this constitutional interpretation has contributed to preventing the further introduction of competition and independent regulatory measures in Indonesia's electricity market.

Electricity Law No. 30 of 2009 established that PLN would remain vertically integrated and control the national transmission network, such that it is the main provider of generation and the sole provider of transmission and distribution networks (although some transmission lines in remote locations can be owned by IPPs). In addition, unlike the previous law, this law did not provide for an independent system operator within Indonesia.

This law also clarified that PLN would no longer have a monopoly on supply and distribution to end customers. In this regard, a licence to provide electricity for public use (IUPTL) may be granted to privately owned businesses, although in practice PLN has the "right of first priority" to supply electricity to customers and generally exercises this right.

The government also implemented new regulations in 2006, 2009, 2012, and most recently in 2013, which introduced feed-in tariffs (FiTs) for the sale of electricity generated from small- and medium-scale renewable energy to PLN. These apply to power plants with technologies that use biomass, photovoltaics, sanitary landfill, zero waste and geothermal energy.

MARKET STRUCTURE

IPPs must sell electricity directly to PLN in its concession area. Private power utilities (PPUs) can also sell electricity directly to the public within certain concession areas. All such agreements are based on PPAs for fixed terms of approximately 30 years or longer. All electricity tariffs are determined and regulated by the government, and approved by national or local parliaments.

Indonesia does not currently have significant cross-border exchange of electricity, although plans for developing transmission lines with Malaysia are under consideration. In general, cross-border power purchases may take place only if local electricity needs cannot be reliably met and national interests of sovereignty and security are not adversely affected.

GENERATION

Approximately 74% of the country's generating capacity is owned by PLN. IPPs provide another 22%, and PPUs provide the remaining 4%.

To address the growing need for electricity, Indonesia announced plans in 2006 to build 10 000 MW of new coal-fired power plants as part of the Fast Track Programme Phase 1. The programme aimed to accelerate investment in much-needed new generating capacity by 2010, 75% of which was built on Java and the remainder in other parts of the country.

Indonesia later announced plans in 2009 to build an additional 10 000 MW of new power plant under the Fast Track Programme Phase 2. At that time, Phase 2 projects aimed to

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develop additional capacity in the following proportions: 48% geothermal; 26% coal-fired; 14% gas-fired; and 12% hydropower. Since the initial tenders, however, as of 2013, the Phase 2 project target has increased to approximately 17 918 MW of new-build projects. Nearly 68% are to be developed by IPPs, and 61% are planned to be coal-fired, 28% geothermal, and 10% hydropower plants.

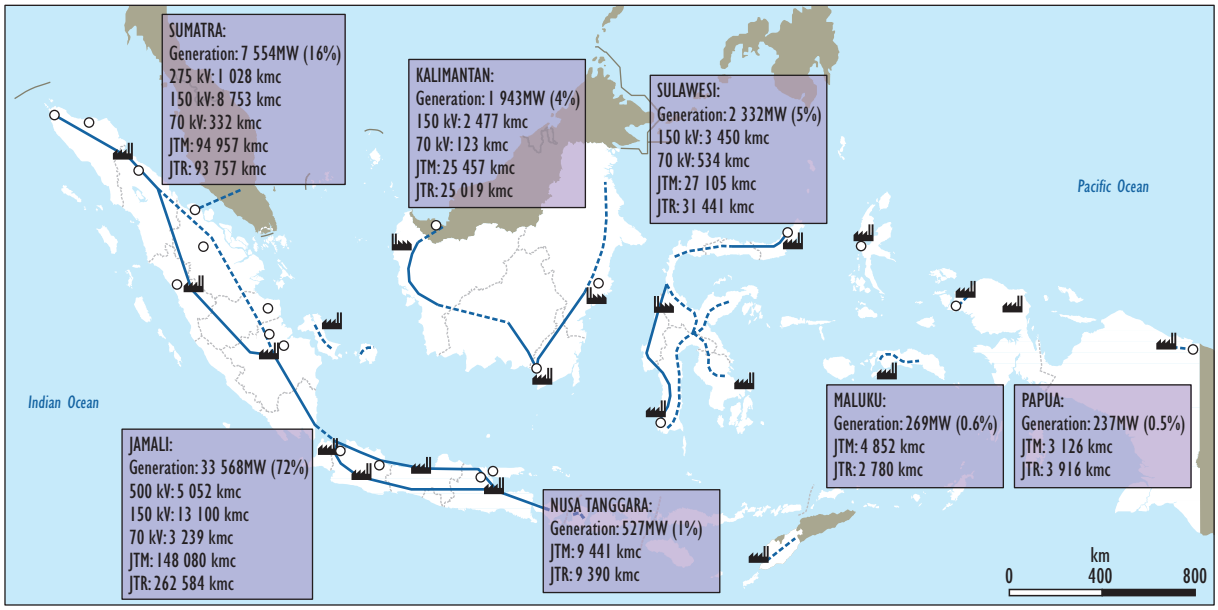
As of September 2013, only 64% of Phase 1 projects were completed and operational. The remaining 3 550 MW of coal-fired plants are targeted for completion during 2014. Approximately 46% of planned power plant capacity under Phase 2 is expected to meet operational deadlines in 2016, with just over half the projects subject to delay.

TRANSMISSION NETWORKS

Almost all transmission networks belong to and are operated by PLN. Certain transmission lines are privately operated and belong to IPPs, particularly those that are close to PLN's substations in remotely located power plant areas.

Transmission networks on the islands of Java, Madura, Bali and Sumatra are connected, although transmission line bottlenecks are a recurring problem. Given its geographic makeup of 17 000 islands, other systems within Indonesia remain isolated (Figure 7.4).

Figure 7.4 Electricity network in Indonesia



This map is 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.

Notes: kmc = kilometre of circuit; JTM = medium-voltage network; JTR = low-voltage network. Total installed power plant capacity up to October 2014 is around 51 981 MW, the length of transmission network is around 39 391 km, and distribution network is around 798 944 km. The electricity systems that have been interconnected are the Java-Bali system and the Sumatra system.

Source: Directorate-General of Electricity (2014a), "New paradigm of national energy policy towards energy security and independence", presentation to IEA, Ministry of Energy and Mineral Resources, Jakarta.

As of the end of 2012, Indonesia's network comprised 38 096 circuit kilometres (km) of transmission lines, and includes high-voltage alternating current lines of 70 kilovolts (kV), 150 kV, 275 kV and 500 kV. Indonesia aims to build more than 55 200 km of new transmission lines by 2021. Plans for high-voltage direct current lines are currently envisaged for future under-water transmission networks.

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PLN has identified key areas for transmission network development as part of its planning. For example, the development of transmission lines for projects under the Fast Track Programme is a priority. PLN also aims to develop an interconnection system between Kalimantan and Sulawesi. Furthermore, transmission connections between West Kalimantan and Sarawak are planned to reduce reliance upon diesel-fired power in those areas. Finally, PLN is considering plans to connect Sumatra with the Malaysian peninsula to optimise operation of Indonesia's power system.

DISTRIBUTION NETWORKS

Similar to transmission networks, Indonesian law stipulates that distribution networks in Indonesia belong to, and are operated by, a utility within a defined area. Each becomes known as an electricity exclusive area of that utility. In practice, all distribution networks belong to and are operated by PLN. The country's electricity distribution network currently uses 20 kV and 380/220 volt lines. Indonesia aims to build more than 425 800 km of new distribution lines by 2021.

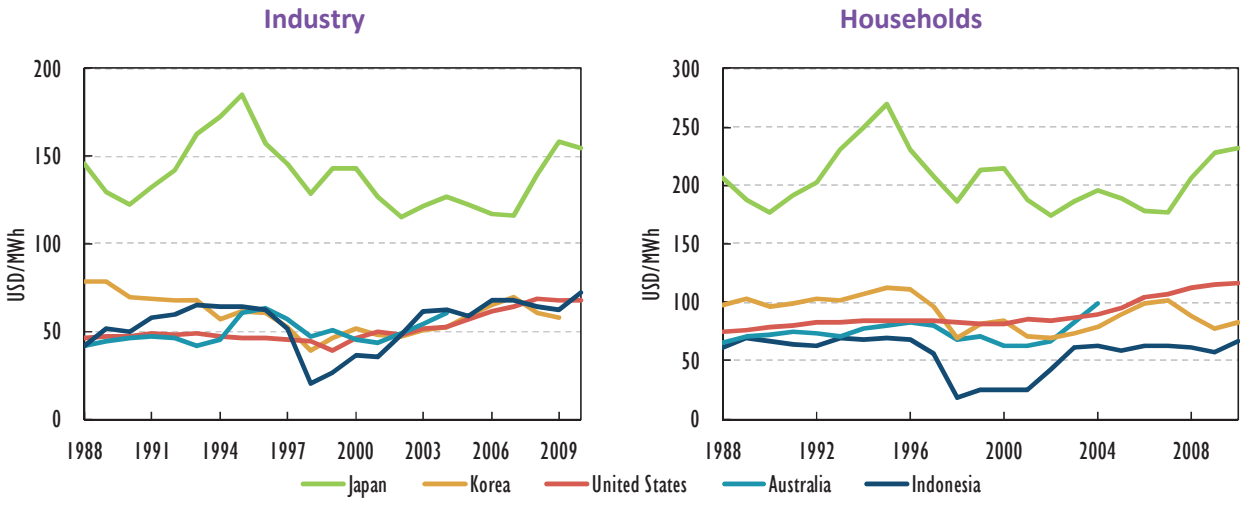
One cross-border interconnection line between Indonesia and Malaysia allows Indonesia to import electricity from Sarawak to West Kalimantan through a 20 kV distribution line.

Indonesia's main priorities for its distribution network are to increase the electrification ratio, improve system reliability and accommodate demand growth.

ELECTRICITY PRICES

As stipulated in Electricity Law No. 30, the government of Indonesia determines prices for electricity, which are given final approval by Parliament. Any differences between the cost of producing and transporting electricity and the price paid by consumers is subsidised by the government. Electricity subsidies continue to be a burden on the government and hinder efforts to improve energy efficiency and demand-side response mechanisms.

Figure 7.5 Electricity prices in Indonesia and in selected IEA member countries, 1988-2010



Notes: price data are not available for industry and households in Australia after 2004; price data for industry in Korea are not available for 2010.

Source: IEA (2011), *Energy Prices and Taxes, Vol. 2011/4*, OECD/IEA, Paris.

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Since 2008, the average electricity tariff has increased from IDR 651 per kilowatt hour (kWh) (USD 0.05) to IDR 745 per kWh (USD 0.06) in 2012, while the average cost of electricity was around IDR 1 272 per kWh (USD 0.10).

Since 2013, electricity tariffs have been incrementally increased for certain consumer groups based on electricity consumption. While subsidies to larger industrial consumers of electricity were abolished in 2008, gradual price increases were announced in 2014 for medium-sized consumers and other industries, according to electricity use (Table 7.1).

Table 7.1 Cost of electricity, electricity tariffs and electricity subsidies

Year	Average electricity cost (IDR/kWh)	Average electricity tariff (IDR/kWh)	Subsidies (trillion IDR)
2003	618	561	3.36
2004	597	584	3.31
2005	710	589	10.64
2006	934	622	33.90
2007	920	627	37.48
2008	1 271	651	78.58
2009	1 009	662	53.72
2010	1 008	703	58.11
2011	1 251	738	93.18
2012	1 272	745	103.33

Source: Directorate-General of Electricity (2014b), "Electricity policy development in Indonesia", presentation to IEA, Ministry of Energy and Mineral Resources, Jakarta.

PLANNING AND FORECASTS

Indonesia has developed ambitious long-term targets for electricity development in the **National Energy Policy (NEP)**, where the government has stated its aim to see 115 gigawatts (GW) of installed generation capacity by 2025.

The government has identified the following priority areas and goals for power generation development in Indonesia:

- to meet demand growth
- to address the lack of electricity supply in parts of Indonesia
- to increase reserve capacity in order to fulfil a reserve margin of 30% to 40% through the prioritisation of local energy sources
- to avoid oil-fired power generation.

Based on the high-level guidelines set out in the NEP, MEMR has a national electricity master plan called the **RUKN** (Rencana Umum Ketenagalistrikan Nasional or General National Power Plan), which makes twenty-year forecasts for power demand and supply, as well as plans for investment and utilisation of renewable energy resources. The RUKN is updated by MEMR annually.

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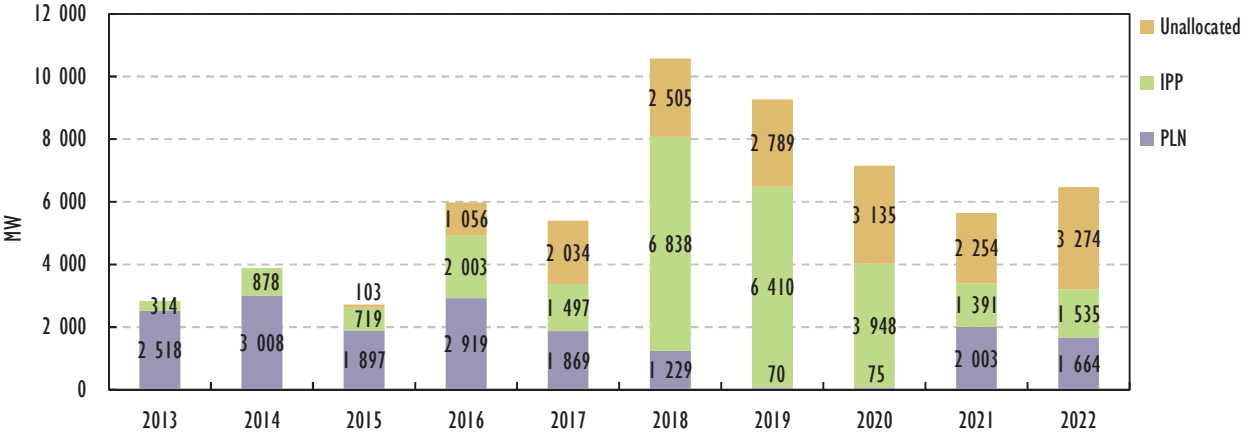
Based on the RUKN, PLN annually publishes a ten-year electricity power supply business plan, the **RUPTL** (Rencana Usaha Penyediaan Tenaga Listrik). This plan provides a projection of power demand at national and regional level. The RUPTL for 2013 to 2022 forecasts that demand will increase by an average of 10.1% per year to 2031.

The RUPTL provides information on PLN's power generation development plans according to fuel type and investment type. The plan distinguishes between PLN-direct tenders, IPP-tenders and unallocated projects. Unallocated projects are either developed by PLN if government or other funds are available, or may be developed by IPPs or PPUs (Figure 7.6).

Figure 7.6 Power generation development planning, RUPTL PLN 2013-22 (MW)



Source: Directorate-General of Electricity (2014b), "Electricity policy development in Indonesia", presentation to IEA, Ministry of Energy and Mineral Resources, Jakarta.

Over the projection period of 2013 to 2022 in the current RUPTL, investment from IPPs is expected to account for a growing share of new generation development, estimated at about 43% by value up to 2022. The plan includes a large number of unallocated projects, comprising around 29% of total forecast generation requirements to 2022. The RUPTL therefore identifies potential opportunities for IPPs to invest in Indonesia's generation sector.

The targeted energy mix for power production in 2022 is 66% coal-fired, 16.3% gas-fired, 11% geothermal, 5% hydropower, and 1.7% oil-fired generation. The government has identified nuclear as the least-preferred option in the new NEP.

The RUPTL also includes plans for investment in transmission and distribution, with the aim of meeting requirements from power system growth and of increasing power system reliability.

The RUPTL identifies the need for significant new transmission investment up to 2018, largely driven by the need to overcome the geographical mismatch between supply and demand centres.

In contrast, distribution investment is forecast to increase relatively consistently over the forecast period. The investment is related to development of the distribution system to increase the electrification ratio, improve reliability and accommodate demand growth.

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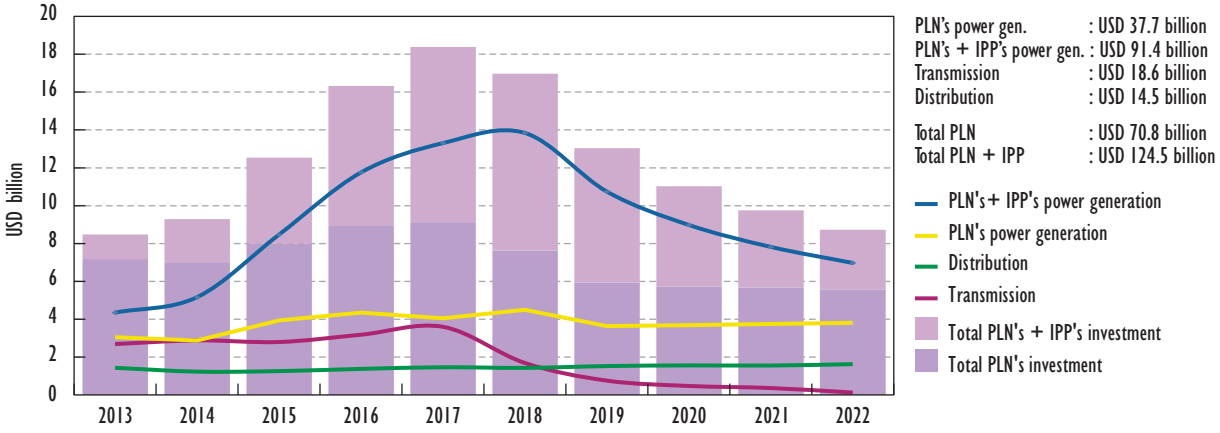
INVESTMENT

To meet current and future demand requirements, Indonesia needs significant investment in power generation. For example, during 2012, nearly USD 7.16 billion was invested across the power sector in Indonesia.

Forecast power sector investment requirements between 2013 and 2022 total USD 124.5 billion, or USD 12.5 billion per annum, of which 73% will be for generation, 15% for transmission and 12% for distribution. PLN expects to deliver 41% of new generation, transmission and distribution capacity, while 59% (nearly USD 54 billion) will depend on IPP investment (Figure 7.7).

Figure 7.7 Required power sector investment, RUPTL 2013-22



Source: Directorate-General of Electricity (2014b), "Electricity policy development in Indonesia", presentation to IEA, Ministry of Energy and Mineral Resources, Jakarta.

The private sector will play an important role in the short- and medium-term development of IPP and PPU projects. Meeting the forecast high rates of growth in demand will necessitate IPP investment. Government support and guarantees, institutional support, regulatory certainty and changes linked to cost-based tariffs are important to improve private sector confidence and lead to the necessary future development of the power sector.

ELECTRIFICATION

The government has set targets to increase electrification rates in line with progress made since the last *Energy Policy Review of Indonesia* (IEA, 2008). Indonesia has seen an increase in the national electrification rate from 65% in 2008 to 80.51% in 2013. The RUKN aims to achieve a national electrification rate of 89.56% by 2017. Indonesia calculates its electrification rate based on the number of national electricity (PLN and PPU) connections, although a single connection can serve more than one household. The highest electrification rates are within the Java-Bali system, with Jakarta having a near 100% electrification rate. The electrification rates are lowest in the outer ring of islands. For example, Papua had the lowest electrification ratio (36.41%) in 2013 (Figure 7.8). While urban electrification is widespread, rural electrification faces a multitude of challenges.

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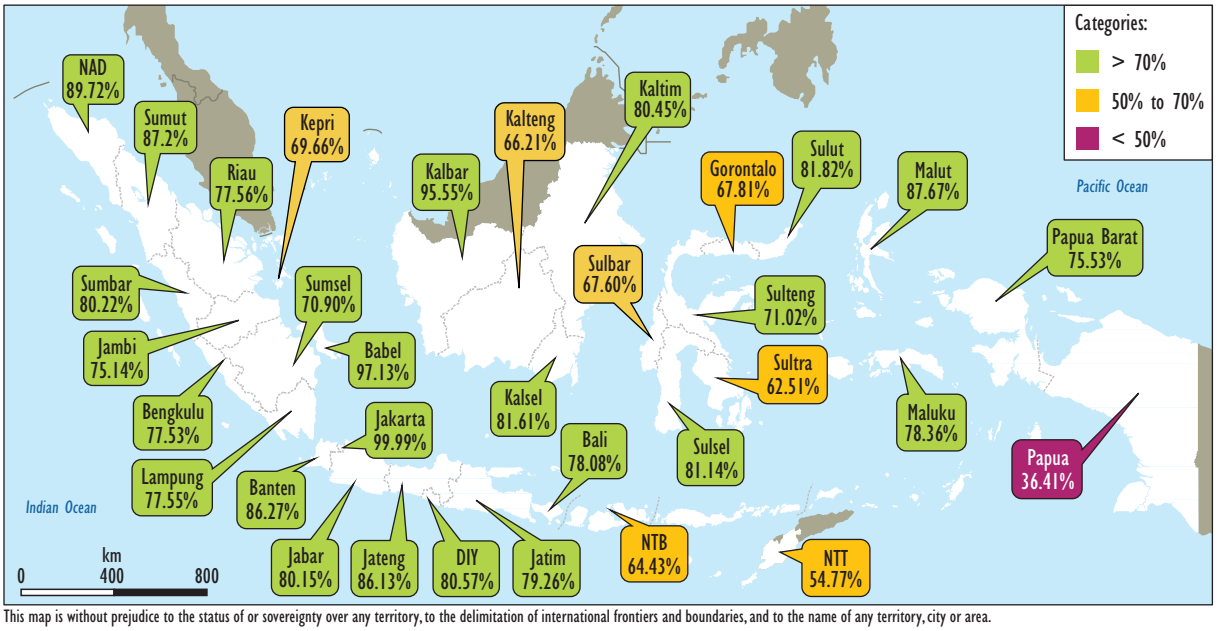
The most challenging areas in the outer ring of islands are off-grid and located far from fuel resources. Such areas have low population densities and low average consumption per capita, which makes cost recovery and significant economies of scale difficult to achieve for investment in grid connection infrastructure. As a result, diesel-fired generation remains prevalent in rural areas, although the use of small-scale power supply schemes, such as solar photovoltaic (PV) and micro-hydro systems, have grown to a limited extent. Realising future targets will require connection of rural areas to integrated electricity grids, where technically and economically feasible, and the development of distributed, small-scale power generation.

Figure 7.8 Electrification rates in 2013



This map is 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.

Notes: NAD = Nanggroe Aceh Darussalam (Indonesia); NTT = Nusa Tenggara Timur (Indonesia province); NTB = Nusa Tenggara Barat (Indonesia province); DIY = Daerah Istimewa Yogyakarta (Indonesia).

Source: Directorate-General of Electricity (2014b), "Electricity policy development in Indonesia", presentation to IEA, Ministry of Energy and Mineral Resources, Jakarta.

ELECTRICITY SECURITY

SECURITY OF SUPPLY

Electricity disruptions in 2013 reduced consumption in the Java-Bali system by approximately 10%. PLN imposes rolling black-outs to maintain system stability in the event of voltage and frequency fluctuations or electricity infrastructure failure. PLN is responsible for ensuring that electricity production meets demand and for implementing operational measures in the event of electricity shortage. To achieve this, PLN needs sufficient information to plan and deliver investment in power generation and transmission networks in a timely and effective manner.

However, as Indonesia does not have metering devices to measure consumed volume, it lacks electricity flow monitoring. This lack of metering makes it difficult to identify and prevent illegal connections. Furthermore, inaccurate monitoring of electricity flows results in widespread supply disruption since networks must meet an unmeasured level

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of demand. The lack of metering may also affect the resilience of the network to flow variations in situations where flow paths cannot be determined.

Security of electricity supply in Indonesia also faces a number of challenges that may compromise its ability to attract and deliver necessary investment. The country has many ongoing and planned projects for developing transmission networks, although securing access to land and finance are proving to be problematic. For example, in the case of some newly built plants, problems connecting with transmission networks have prevented them from going online. Similarly, there are problems that cross sectors. Natural gas power plants in East Kalimantan and North Sumatera have ceased operations due to the lack of natural gas supply from neighbouring natural gas fields.

Maintaining a secure supply of electricity requires the government of Indonesia to adopt a comprehensive approach to energy policy. Furthermore, forward planning is necessary to attract timely and effective investment in the power sector.

POWER SYSTEM RELIABILITY AND EMERGENCY RESPONSE POLICY

Ensuring a safe, secure and properly functioning electricity system is important to Indonesia. PLN is responsible for maintaining the reliability of the system. It enters into contracts with the relevant generators to guarantee the provision of generation capacity when required. In addition, PLN plans the networks to meet reliability requirements specified in grid codes. In this regard, the government has stipulated grid codes for the networks on Java-Bali and Sumatra, and grid codes are currently being drafted for the Kalimantan and Sulawesi networks.

PLN also has responsibility for electricity emergency response resources and contingency planning for the electricity system in Indonesia. Partially due to the geographical condition of Indonesia, system networks are not integrated and, as such, contingency planning and emergency management resources, such as crisis alert level and load shedding plans for system co-ordination, are yet to be developed. However the government is currently working to improve this situation. In addition, government intervention and implementation procedures, to complement PLN's operational measures during electricity shortages, are pending in a draft Presidential Decree.

ASSESSMENT

Although Indonesia updates its 20-year power development plans each year, the country faces a shortfall in electricity capacity over the next ten years. Brown-outs and wider supply disruptions are frequent as a result of a lack of generation and network capacity. A number of challenges in the electricity sector may prevent the government meeting its medium- to long-term targets.

Planning and development

Electricity planning and policy development in Indonesia are based largely on a top-down approach, which can lead to conflicting and unclear government priorities. For example, electricity fuel mix targets, which are shifting towards a significant increase in coal-fired power plants, are not in line with national climate change policies and targets to reduce carbon emissions.

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In addition, the government has set ambitious development plans for generation. Such plans include a significant number of power plant projects that are "unallocated". More specifically, Indonesia's generation plan does not define if such unallocated projects will be developed by PLN or will rely on the investment of IPPs. The government develops unallocated projects if funding is available; if funds are not available, however, the government opens unallocated projects to IPP tender. The decision making on whether the government will fund projects directly or turn to the private sector for investment is not decided before setting power development plans, and lacks transparency on how, or when, projects will be developed.

The uncertainty of unallocated projects creates an unfavourable investment environment for the private sector, as developers cannot make long-term investment plans. Furthermore, lack of certainty around project viability creates delays in investment. In Indonesia, where there is an emerging and significant generation capacity shortfall, this approach may undermine future electricity sector security.

Transmission networks in Indonesia are generally underdeveloped and require significant expansion. The present approach to transmission investment in Indonesia, however, has resulted in transmission constraints, as coal-fired power stations in eastern Java are unable to supply industrial demand in western Java. PLN has identified plans for transmission development on a year-on-year basis as part of the RUPTL. The plan, however, lacks comprehensive transmission planning from a system-wide perspective and the alignment between transmission and generation is not clearly made. This can lead to inefficient investment for both transmission and generation, as regards timing, location and selection of generating technology.

In addition to the need for transmission network development, the local low-voltage distribution network requires strengthening to meet Indonesia's electrification goals and improve system reliability. Distribution network planning is highly dependent on the need for clearly defined reliability, quality and safety requirements. However, easily accessible information about such requirements is currently unavailable, and it is unclear how they fit into the distribution system development goals identified by the government of Indonesia. Furthermore, while these plans are recognised by PLN, the priorities and areas for distribution network development have not been clearly identified as part of the RUPTL. As with transmission development, distribution development needs to be linked with broader electricity objectives, in this instance with year-on-year generation and electrification targets.

Distribution development needs are highly dependent on regional factors. Given Indonesia's diverse geography and population concentrations, planning would benefit from a bottom-up approach, where initial planning is undertaken at the sub-national level with approval, prioritisation and oversight at the national level by PLN to ensure consistency and adequacy.

There is currently a lack of co-ordination in planning across the electricity system, from production to load. Without such planning for generation, transmission and distribution, the risk remains that power plants and networks will not be able to deliver expectations of reliability and quality of supply, deliver an optimal system from production to load, or meet these demands on time.

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Regulatory oversight and government processes

Indonesia does not have an independent electricity regulator or transmission system operator (TSO) for enhanced technical monitoring of power sector operations. PLN is responsible for both technical and financial regulation of electricity supplies in its concession areas. PLN's responsibility for investment and revenue recovery represents a potential conflict of interest because it has to assess whether its own actions have delivered "reasonable cost" electricity for consumers and not at the cost of the government. The separation of financial reporting for PLN's distinct business functions (generation, transmission, and distribution) would help improve the accountability and transparency of each.

An independent regulator would not have this perception of conflict, as its sole function would be to allow for appropriately balancing cost, reliability, quality and safety of supply throughout the system, from planning to operation. This would improve investor confidence in Indonesia's electricity sector and improve efficiency of outcomes for consumers and the government. An independent regulator would allow Indonesia to have significant influence over long-term planning, and help to create the stable environment necessary to attract investment. For example, an independent regulator could set service requirements and determine appropriate rates for utilities to charge consumers. A lack of co-ordination, excessive regulatory burden and uncertainty result in inefficient outcomes across the energy sector, and this is not limited to electricity. Such excessive regulation carries through into development of the power sector.

Power sector stakeholders have experienced lengthy approval processes and administrative burdens during power project development. A lack of co-ordination and process transparency contributes to uncertainty in the investment environment of Indonesia. For example, delays across national and sub-national government institutions in approval processes (such as land acquisition) constrain efficient, timely and transparent tendering, and therefore development of power plant projects and transmission infrastructure.

Investment

PLN is responsible for purchasing all electricity from generators in its concession areas and then selling it to end consumers. The retail price of electricity, however, is below the average cost of generation paid by PLN, leaving it with a shortfall.

Reform of retail tariffs is essential for providing investor confidence as well as delivering other government priorities. Properly designed tariff structures should be based on an accurate view of the underlying utility costs, and should allow the utility to recover those costs with a reasonable rate of return. Costs should also be allocated appropriately – for example, in proportion to the level, or even time, of consumption. Modern tariff design also seeks to provide incentives both for effective and efficient service provision by the utility, and efficient use on the part of the consumer.

As PLN is responsible for directly negotiating all PPAs and may be the financial guarantor of PPAs (which is established on a case-by-case basis), the regular loss-making financial status of PLN has led to a situation where some generators have not been able to secure financing or face significant risks for PLN-guaranteed investments.

In this regard, government guarantees are an important condition of support for IPPs in large-scale power project development, particularly to improve investor confidence.

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Only projects under the Fast Track Programme Phase 2 or those that receive financing through the Indonesia Infrastructure Guarantee Fund (IIGF) are eligible for government guarantees.

In 2011, Indonesia's Ministry of Finance passed a regulation mandating the issue by government of a "business viability guarantee" letter (BVGL) to assist in covering risk of non-payment by PLN to IPP projects under the Fast Track Programme Phase 2. The BVGL's coverage, however, is limited as it only applies for a duration of 12 months (48 months for geothermal projects). If IPPs are unable to meet financial close[2] within this short period, the letters become invalid, with no potential for extension or renewal.

If financial close can be met, the investor then faces additional risks before commercial operation of a plant. The BVGL only applies to invoices issued after the project has entered commercial operation, and does not apply to start-up or commissioning phases of a power plant. Furthermore, the BVGL guarantees are not given directly to an IPP. The BVGL is provided to PLN in respect of a specified IPP project. In essence, the BVGL does not cover PLN's payment obligations in case of PPA termination.

Another mechanism for improving project financing support is through the IIGF, which is a state-owned entity that can provide credit support for public-private partnership infrastructure projects in which the Ministry of Finance acts as co-guarantor for projects. Only projects that go through a competitive bidding process can potentially receive IIGF guarantor support from the government. Only one power project has been issued under this scheme since inception of the IIGF in 2011. The fund has a USD 1.0 billion total funding cap, which is available for all types of infrastructure project (not only power). Consequently, funding for power projects is limited as many sectors compete for the support, and the IIGF cannot actively mobilise private power sector development in Indonesia.

In view of PLN's history of PPA default and financial troubles dating to the Asian financial crisis, government support in the form of a financial guarantee is needed to generate IPP investor confidence. As electricity infrastructure investment has a long lead time, and as Indonesia turns to private investment for power generation development, an improvement in the investment environment is critical for meeting the electricity system needs of Indonesia.

RECOMMENDATIONS

The government of Indonesia should:

- *Improve the investment climate for IPPs by introducing enhanced financial incentives for investment and transparent price formation for generators, and by maintaining the process of electricity subsidy reform.*
- *Re-organise the structure of PLN into its principal activities of generation, transmission and distribution, each with separate management and accounting structures. This will allow separate reporting of costs within each business unit, and drive greater efficiencies.*

2. Financial close occurs when all the project and financing agreements have been signed and all the required conditions contained in them have been met. It enables funds (e.g. loans, equity, grants) to start flowing so that project implementation can actually start.

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- *Ensure that PLN is creditworthy and also offer tailored guarantees where appropriate.*
- *Establish an electricity regulator to be responsible for oversight of the power sector, enforcement of the regulatory framework and provision of technical licences for operating in the power sector.*
- *Develop a generation capacity plan and transmission forecasts in full consultation with all industry stakeholders, including potential investors in generation capacity. A distribution network plan needs to be developed for increased access to energy for all Indonesians.*
- *Establish a single office, or utilise the existing Investment Board, to be mandated to facilitate timely approval of permits related to infrastructure investments in renewable energy, electricity and natural gas with the authority to fast-track critical projects.*
- *Improve day to day communication between the government and all stakeholders involved in the power industry, particularly the private sector/independent power producers.*

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8. RENEWABLE ENERGY

Key data (2012)

Share of renewable energy: 33.4% of TPES and 11.4% of electricity generation (IEA median: 9.7% of TPES and 19.4% of electricity generation)

Biofuels and waste:[1] 25.3% of TPES and 0.1% of electricity generation

Geothermal: 7.6% of TPES and 4.8% of electricity generation

Hydro: 0.5% of TPES and 6.5% of electricity generation

OVERVIEW

BACKGROUND

Hydropower Indonesia's potential for renewable energy is high, although the majority of resources are located far from demand centres. The country holds around 28 gigawatts (GW) or 40% of the world´s geothermal reserves, about 32 GW of potential biomass reserves and 75 GW of hydro energy resources. It also has considerable solar energy potential of about 1200 gigawatt electrical capacity (GW_e).

Despite the challenge of connecting renewable resources to areas of demand throughout Indonesia's 6 000 inhabited islands, renewable energy could significantly enhance the provision of basic energy needs on isolated islands and rural off-grid areas, as the cost of transporting fossil fuels to far-off islands is high.

The government has implemented feed-in tariffs (FiTs) and tax incentives to encourage investment in the renewable energy sector. For example, the government is supporting subsidies for transport biofuels. The government has also implemented programmes such as the Energy Self Sufficient Village (ESSV) and the Solar Home System programme aimed at isolated rural areas. Furthermore, the second phase of the Fast Track Programme to build 10 000 megawatts (MW) of power plant includes a plan for 6 000 MW of geothermal and hydropower plants.

Renewable energy plays an important role in Indonesia's national energy policies, particularly as maximising renewable resources helps strengthen the security of energy supply. Indonesia, however, is currently exploiting only around 5% of its renewable energy capacity. The government aims to speed up the exploitation of renewable energy and to increase its share of primary energy to 23% by 2025.

1. The category "Biofuels and waste" is an official statistical category that includes solid biofuels (commonly referred to as "solid biomass"), biogases, liquid biofuels, and the renewable portion of municipal waste (for more details see www.iea.org/statistics/resources/balancedefinitions/). This publication uses the term "biofuels for transport" for liquid fuels derived from organic material that are used as fuel in the transport sector, including biodiesel and ethanol.

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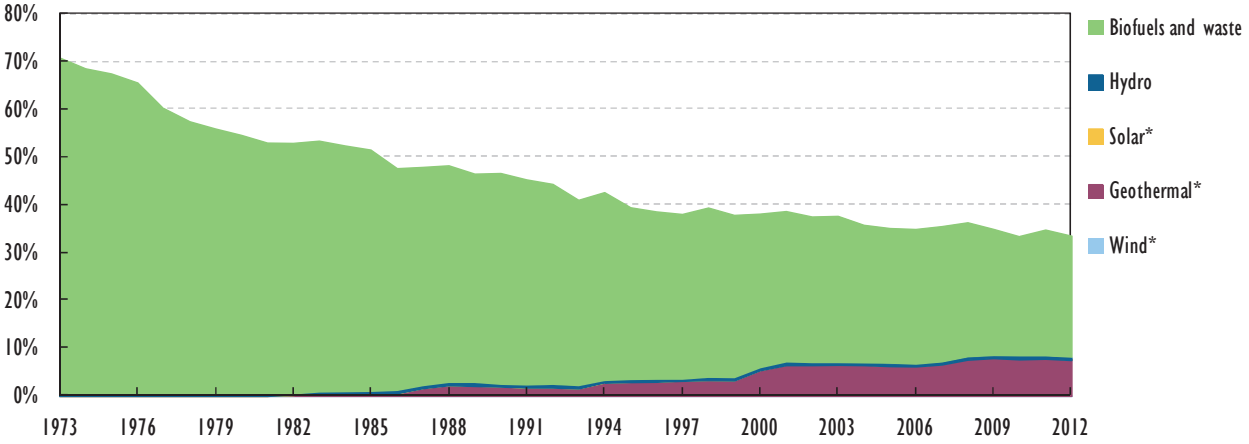
RENEWABLE ENERGY SUPPLY AND DEMAND

Renewable energy accounted for 33.4% of total primary energy supply (TPES) in Indonesia in 2012. This amounts to 71.4 million tonnes of oil-equivalent (Mtoe) (282.3 million barrels of oil-equivalent), made up primarily of biofuels and waste biomass (25.3% of TPES). The remainder is from geothermal (7.6%), hydro (0.5%) and negligible levels of wind and solar power.

Since 2002, the share of renewables in TPES has declined from 37.5%, mainly due to very slow growth in biofuels and waste at the time when total energy supply is growing steadily (Figure 8.1). Energy from biofuels and waste increased by 0.7% per year, which is the slowest rate of growth of all the fuels in Indonesia's energy mix. The strongest growth in renewables was in geothermal energy, which grew by 4.2% per year. As such, the share of biofuels and waste biomass in TPES has fallen from 30% in 2002 to 25.3% in 2012, while the share of geothermal has increased from 6.5% to 7.6% over the same period.

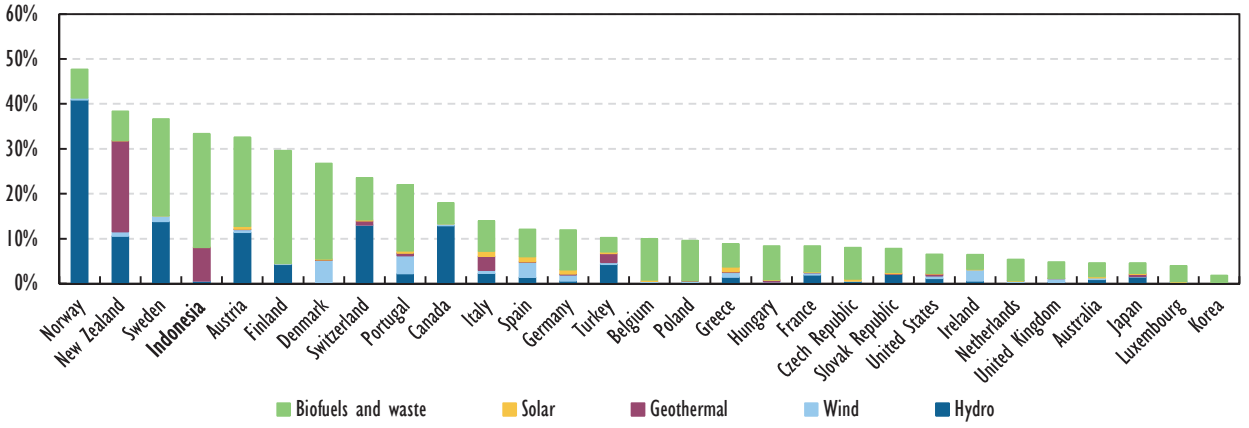
Figure 8.1 Renewable energy as a percentage of TPES, 1973-2012



* Negligible.

Source: IEA (2014a), *Energy Balances of Non-OECD Countries 2014*, OECD/IEA, Paris.

Figure 8.2 Renewable energy as a percentage of TPES in Indonesia and IEA member countries, 2012



Sources: IEA (2014b), *Energy Balances of OECD Countries 2014*, OECD/IEA, Paris; IEA (2014a), *Energy Balances of Non-OECD Countries 2014*, OECD/IEA, Paris.

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Indonesia has the fourth-highest share of renewables in TPES if compared to IEA member countries, behind New Zealand, Norway and Sweden. It has the second-largest share of biofuels and waste in TPES after Finland and the second-largest share of geothermal in TPES behind New Zealand (Figure 8.2).

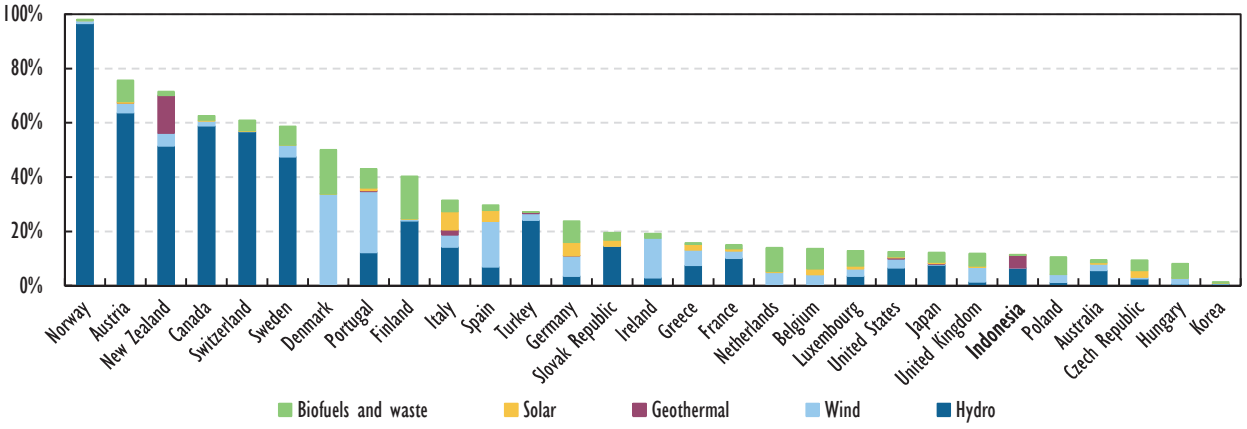
ELECTRICITY GENERATION

Electricity generation from renewable sources amounted to 22.4 terawatt hours (TWh) in 2012, which is 11.4% of total generation. This mainly comprises hydro (6.5%) and geothermal (4.8%). Biofuels and waste share only 0.1% of generation, while wind and solar power are still at an early stage of development.

The share of renewables in electricity generation has fallen from 15% in 2002 to 11.4 in 2012, due to slower growth in hydro and geothermal compared to coal. The annualised growth rate in hydropower was 2.6% between 2002 and 2012 and 4.2% for geothermal, while total generation grew at 6.1% per annum. The use of biofuels and waste increased by 29.3% per year from 2002 to 2012, although their overall share in generation is still below 1%.

Indonesia ranks sixth lowest if compared to IEA member countries in terms of the share of renewable energy in electricity generation (Figure 8.3). The IEA median is 19.4%.

Figure 8.3 Electricity generation from renewable sources as a percentage of all generation in Indonesia and IEA member countries, 2012



Sources: IEA (2014b), *Energy Balances of OECD Countries 2014*, OECD/IEA, Paris; IEA (2014a), *Energy Balances of Non-OECD Countries 2014*, OECD/IEA, Paris.

INSTITUTIONS

Indonesia has rather complex institutional and stakeholder arrangements in the renewable energy sector. A number of government agencies are directly involved in formulating or implementing renewable energy policy at the national level, with local governments and a number of other government agencies also having influence over policy formulation and implementation (Figure 8.4).

The **Ministry of Energy and Mineral Resources (MEMR)** is the main institution that formulates policy and regulates the development of renewable energy under the supervision of the Co-ordinating Ministry of Economic Affairs. In 2010, MEMR established a new Directorate-General of New, Renewable Energy and Energy

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Conservation (DGNREEC). DGNREEC serves as a focal point for renewable energy policy formulation in Indonesia.

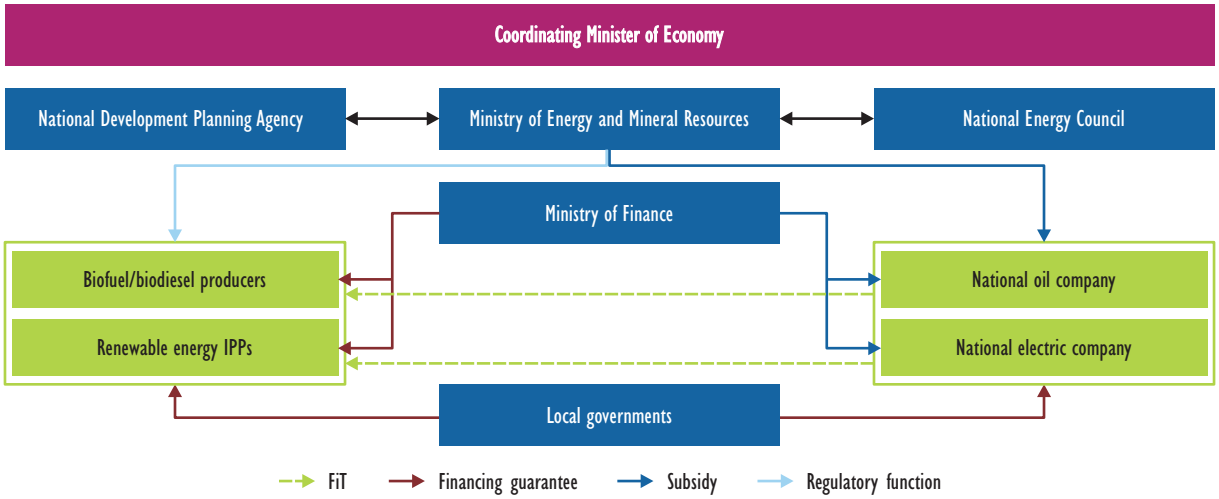
The **Co-ordinating Ministry of Economy** is responsible for the development of energy infrastructure through the Masterplan for Acceleration and Expansion of Indonesia's Economic Development (MP3EI) and co-ordinates renewable energy policy formulation between the other actors.

The **National Energy Council (NEC)** was established in 2009 and is chaired by the President of Indonesia. The NEC works to co-ordinate national energy general planning and regional energy general planning, and to define the authority of central and local governments.

The **Ministry of Finance (MoF)** contributes to renewable energy policy, and approves expenditure for the implementation of regulations concerning fiscal and tax incentives for renewable energy projects, such as the reduction of import taxes for technical components. The MoF established the Indonesia Clean Technology Fund, which provides USD 250 million for equity enhancement towards clean technology projects in Indonesia.

The **Ministry for National Planning (BAPPENAS)** influences the direction of policy on renewable energy, although is not directly involved in the implementation of renewable energy regulation. BAPPENAS recently established a roadmap for the promotion of renewable energy infrastructure.

Figure 8.4 Government institutions for renewable energy in Indonesia



Source: Damuri, Y.R. and R. Atje (2013), *Investment Incentives for Renewable Energy: Case Study of Indonesia*, International Institute for Sustainable Development, Winnipeg.

The **Ministry of Research and Technology** and its Agency for the Assessment and Application of Technology (BPPT) are involved in formulating research and development and implementation of renewable energy technologies.

The **Ministry of Agriculture** is involved in the development of bioenergy via its responsibility for agricultural and plantation practices, including palm oil plantations.

The **Ministry of Forests** and **the Ministry of Environment** are involved in both bioenergy and geothermal-related issues, as many plantations are located in forest areas and environmental protection measures apply.

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The state-owned company **PLN** is the national supplier of electricity and controls the electricity grid. PLN is involved in renewable energy projects such as the 1 000 Island solar photovoltaic (PV) project.

Local and regional governments have become important stakeholders in the implementation of renewable energy policy, as they develop regulations and issue permits concerning energy planning. Furthermore, as part of promotional strategies to attract investment, local and regional governments can provide schemes that influence the implementation of energy sector policies. Local governments together with other local stakeholders, therefore, often initiate the development of renewable energy projects in the regions. Financing may come from the regional government budget (especially for off-grid renewable energy systems).

The **Indonesian Renewable Energy Society** is a forum established in 1999 to promote renewable energy in Indonesia. Its membership includes the private sector, research institutions and the government. It aims to facilitate co-ordination between the various associations and fora, including Indonesian Geothermal Association, Micro Hydro Association, Solar Cell Entrepreneur Association, Indonesian Association of Bioenergy, Indonesian Biodiesel Forum and Wind Energy Entrepreneur Association.

The **Indonesian Biodiesel Forum (FBI)** was established in February 2002 and currently comprises a few hundred members from government, research organisations, non-governmental organisations and the private sector. FBI aims to promote the production and use of biodiesel in Indonesia to achieve sustainable energy supply security and economic development. This is done through raising awareness among the public at large about the role that biofuels for transport can play, and by facilitating the exchange of information among the various stakeholders.

The **National Team for Biofuel Development** was established by Presidential Decree No. 10/2006 with the mandate to develop a blueprint for increasing the use of biofuels. The team consists of representatives from several ministries and other governmental bodies, research organisations and the private sector.

The **Indonesia Geothermal Association (API)** was established in 1991 to promote geothermal energy in Indonesia. API is a scientific, educational, cultural, non-governmental and not-for-profit organisation. Its approximately 500 members include geothermal experts, companies and other stakeholders.

POLICIES AND SUPPORT MEASURES

The **Blueprint for National Energy Implementation 2005-25**, issued in 2005, establishes the framework for Indonesia's development of a secure and sustainable energy supply, including a sectoral roadmap for renewable energy and programmes to phase out subsidies and improve energy efficiency. Under its "Optimising Energy Management" scenario, renewable energy plays an increasingly important role in Indonesia, particularly geothermal and biofuels. The Blueprint projects the share of renewables in the primary energy supply to grow to 17% in 2025.

The **National Energy Policy 2014** recognises the growing role of renewables in meeting energy security, economic development and environmental protection goals. The target for renewable energy's share in the primary energy mix is 23% by 2025. To achieve this target, the government is actively working to enhance the investment and regulatory environment for renewable energy projects.

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The government has implemented and introduced the following policies and regulations:

The **Green Energy Policy** (Ministerial Decree No. 2/2004) identifies Indonesia's strategy to maximise the utilisation of its renewable energy potential and to build public awareness of energy efficiency measures. The government provides incentives for the development of local renewable energy industry in areas such as West and East Nusa Tenggara, Molukken and Papua.

Ministerial Regulation No. 2/2006 on Medium-Scale Power Generation using Renewable Energy, and Ministerial Regulation No. 31/2009, oblige PLN to buy electricity from renewable energy produced by independent power producers (IPPs). The government determines the respective tariff structures. The level of the FiT depends on the technology and the location of the renewable energy power station. The maximum capacity of each power plant is 10 MW and purchase contracts are negotiated for ten years or longer.

Ministerial Regulation No. 04/2012 introduced a FiT for biomass, biogas and municipal solid waste. The FiT guarantees access to the grid for generators and obliges PLN to purchase up to 10 MW of electricity from these sources. The regulation is currently being revised to improve prices, procedures and permits for developers.

The Ministry is improving Ministerial Regulation No. 04/2012 by releasing a set of specific regulations to address the renewable resources, as follows:

- (1) Ministerial Regulation No. 17/2013 on a Ceiling Price and Quota System for Solar Energy
- (2) Ministerial Regulation No. 19/2013 on FiTs for Municipal Solid Waste
- (3) Ministerial Regulation No. 12/2014 on Hydropower. This regulation has been revised in 2014 by referencing the Utilisation of Dams for Power Plant (No. 22/2014)
- (4) Ministerial Regulation No. 17/2014 on a Ceiling Price for Geothermal.

The **Ministerial Regulation on Small Distributed Power Generation Using Renewable Energy** was implemented in 2002 with the objective of promoting small-scale renewable energy power plants, by allowing enterprises to sell their power production or surplus power to the local utility's power grid (if readily accessible). The maximum allowable capacity of the power plant is up to 1 MW and the electricity price is 60% of the utility's production cost if it is connected to the low voltage grid, and it is 80% of the utility's production cost if it is connected to medium voltage grid.

FITS AND OTHER SUPPORT INSTRUMENTS FOR RENEWABLE ENERGY

FiTs are available for hydropower, geothermal, biomass and waste, and solar technologies in Indonesia. In 2013, the government introduced an auction programme to award FiTs to utility-scale solar projects with a quota of 140 MW set for 2013/14 and ceiling prices of USD 0.25 per kilowatt hour (kWh) to USD 0.30/kWh, depending on local content. It is hoped that these incentives will stimulate renewable deployment over the medium term. A full list of incentives is provided in Table 8.1.

The government has implemented a number of fiscal and financial incentive instruments, including the USD 400 million Clean Technology Fund, which was created in 2009 to promote renewable energy, to improve electrification rates, and to enhance energy efficiency within Indonesia. The fund's predominant focus is on developing Indonesia's large-scaled geothermal projects.

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Table 8.1 Overview of investment incentives for renewable energy

Incentive scheme	Regulation	Remarks
The geothermal fund	MoF Regulation No. 3/2012	Provides finance for exploration, only to be paid for if sites prove productive. Survey and exploration services, only to be paid for if sites prove productive.
Development credits for biofuels and plantation revitalisation	MoF Regulation No. 117/2006 MoF Regulation No. 79/2007	Low-cost loans for farmers and farmer groups that plant energy crops.
Government financial guarantee	MoF Regulation No. 139/2011	Government guarantee for geothermal and hydropower plant projects as part of Fast Track Programme Phase 2.
Income tax reduction	MoF Regulation No. 21/2010	Adjustments to income tax on energy development projects, including net income reduction, accelerated depreciation, dividends reduced for foreign investors and compensation for losses.*
FiTs	MEMR Regulation No. 4/2012 MEMR Regulation No. 22/2012 MEMR Regulation No. 17/2013 MEMR Regulation No. 19/2013 MEMR Regulation No. 12/2014 MEMR Regulation No. 17/2014	FiT for biomass and mini-hydropower plant. FiT for geothermal power plant. FiT for municipal solid waste. FiT for solar energy.
Mandatory utilisation	MEMR Regulation No. 32/2008	Obligatory usage of biofuels in fuel mix. Mandatory usage of biofuels in mining industry.

* Example: incentives for geothermal projects include an investment credit of 20% of the qualifying capital investment, an extended tax loss carry forward period for up to ten years, accelerated depreciation rates and a maximum dividend withholding tax of 10%.

RENEWABLE ENERGY ELECTRICITY

In Indonesia, renewable power accounted for approximately 12% of power generation in 2013. An overview of potential and installed capacities is presented in Table 8.2. Hydropower and geothermal are the main renewable sources and contributed 7.9% and 4.4% of total electricity in 2013, respectively. Hydropower capacity has expanded slowly in recent years and grew by less than 100 MW in 2013 (MEMR, 2014). Geothermal capacity has steadily grown over the past decade, although project development has seen delays due to permit approval procedures and land acquisition difficulties. Bioenergy is also an important renewable source. Thus far, solar and wind have played only a marginal role in Indonesia's renewable mix, although future development is expected.

Table 8.2 Potential and installed capacity of renewable energy resources in Indonesia (MW)

Technology	Potential	Installed capacity
Hydro	75 000	7 572
Geothermal	28 617	1 343.5
Mini/micro-hydro	1 013	88
Biomass	32 654	1 716.5 of which 1 626 off-grid 90.5 on-grid
Solar	4.8 kWh/m^2/day	42.77
Wind (3 to 6 metres/second)	9 290	1.87
Ocean energy	49 000	0.01

Source: Directorate of New Renewable Energy and Energy Conservation (2014), "New and renewable energy and energy conservation sector strategy", presentation to IEA, March 2014, Ministry of Energy and Mineral Resources, Jakarta.

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GEOTHERMAL

Indonesia is located in the "ring of fire" volcano belt and is estimated to hold approximately 40% of the world's geothermal reserves, equivalent to some 27 000 MW of power. The country's geothermal resources have the benefit of being situated near demand areas, with most geothermal potential to be found on Sumatra (13 800 MW), Java and Bali (9 250 MW) and Sulawesi (2 000 MW). Potential reserves and proven reserves amount to some 12 200 MW and 2 000 MW respectively in 125 locations throughout Indonesia. Of this, 964 MW, mainly located on Java and Bali, have been developed.

The development of geothermal power is based on Law No. 27/2003 (recently revised) and Governmental Regulation No. 59/2007, which regulate the management and development of Indonesia's geothermal energy resources for direct and indirect utilisation. The aim of the legislation is to manage geothermal activities in support of sustainable development and to increase national income in support of national economic growth.

Geothermal capacity has steadily grown over the past decade and is estimated to have reached approximately 1 400 MW in 2013, although short of the planned 2 000 MW target for 2008. According to the roadmap of geothermal development, Indonesia aims to install capacity of 6 000 MW by 2020 and 9 500 MW by 2025.

In 2001, the government issued new regulations under the 2003 Geothermal Law, which set a maximum tariff of USD 0.097 per kWh for geothermal electricity, and required PLN to buy geothermal power upon successful negotiation of a power purchase agreement (PPA). It also provided for prices above USD 0.097 per kWh upon negotiation with PLN.

As such, in 2011, Governmental Regulation No. 02/2011 obliged PLN to purchase geothermal electricity in accordance with tendered FiT levels. Moreover, in 2012, the government increased the FiT to between USD 0.10 and USD 0.185 per kWh, depending on where the plants are located and on which voltage level the electricity is fed in. The government expects that the latest tariff will encourage companies to increase investment in geothermal energy.

These financial incentives will need to be coupled with an increased availability of lower-cost financing and a reduction of non-economic barriers for projects to be attractive. To this end, the government has used financial instruments from multilateral actors, such as the World Bank, the Asian Development Bank, and bilateral institutions from France, Germany, Japan, the Netherlands, and New Zealand, to enhance the implementation of geothermal projects. The Clean Technology Fund (CTF) provided USD 400 million towards geothermal development in Indonesia, which was followed by concessional loans from the World Bank, the CTF, and investment funds from Pertamina. In addition, a geothermal fund was established with USD 145 million to finance initial feasibility studies of geothermal working areas before putting them out to tender.

But the development of geothermal projects continues to be challenged by complex regulatory requirements in Indonesia. For example, about 42% of Indonesia's geothermal energy is located in forest conservation areas, in which mining activities require presidential approval and have been halted under a moratorium. Under current law, geothermal exploration is considered a mining activity, which therefore, hinders project development.

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Indonesia is revising its geothermal law so that projects would no longer be considered as mining operations. The House of Representatives (DPR) has formed a special committee for a revision of the law passed in August 2014 to accelerate the development of energy sources.

Approval processes between national, regional and local governments also hinder the development of geothermal. If the proposed project lies within a district boundary, then approval for the project lies with the district government. Where the geothermal resource crosses a district boundary, approval is required from the provincial government. Where the geothermal resource crosses a provincial boundary, approval is required from central government.

HYDROPOWER

Hydropower offers the greatest potential of all renewable energy resources in Indonesia, estimated at more than 75 GW. However, most of this potential is located in areas such as West Papua, far from demand centres. The geographical mismatch in supply and demand is the main reason that total installed hydropower capacity stands at 4 300 MW, or around 5% of total potential. The government's aim to develop industrial zones in Papua and other rural areas under the Masterplan for Acceleration and Expansion of Indonesia's Economic Development could help increase the exploitation of medium- and large-scale hydropower resources.

Mini and micro-hydro (50 kilowatts [kW] to 500 kW) installed capacity is estimated to be 88 MW, which amounts to 17.2% of total identified potential of 500 MW. Most micro-hydro systems are not connected to the grid and are located in remote areas. Such systems can play a significant role in meeting rapidly growing rural electricity demand. However, a considerable number of mini and micro-hydro projects are not running due to a lack of local expertise and maintenance.

Table 8.3 FiTs for hydropower <10 MW

Region	IDR/kWh
Java-Bali	656 (MV)-1 004 (LV)
Sumatra and Sulawesi	787 (MV)-1 205 (LV)
Kalimantan, Nusa Tengara Balat, Nusa Tengara Timur	853 (MV)-1 305 (LV)
Maluku and Papua	984 (MV)-1 506 (LV)

Notes: LV = low voltage; MV = medium voltage.

Source: IEA Indonesia Questionnaire, 2014.

BIOENERGY

Biofuels

Indonesia is endowed with various sources of biofuel, including palm, corn, molasses, cassava and jatropha, which can be used to make biodiesel, bioethanol and bio oil. Indonesia's renewable energy policy places a strong focus on the development of biofuels, as the country is also the world's largest producer and exporter of palm oil products.

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Indonesia has focused on the development of biofuels in response to increasing crude oil prices and decreasing domestic oil production. Biofuel development is also seen as a means of increasing economic growth through investment and export, creating employment (especially in the plantation sector), and alleviating poverty in rural areas of Indonesia.

In 2006, Presidential Decree No. 01 established the National Team for Biofuel Development in Indonesia. This committee created a blueprint and roadmap for a national biofuel development programme and regulations for all aspects of the biofuels supply chain, including plantation, processing, marketing and distribution. The national committee advises regional governments on how to increase economic development through biofuel programmes.

The committee has formulated ambitious targets for biofuel supply (Table 8.4).

Table 8.4 Indonesia's biofuels roadmap

	2011-15	2016-25
Biodiesel	15% of diesel fuel consumption: 4.52 million kL	20% of diesel fuel consumption: 10.22 million kL
Bioethanol	10% of gasoline consumption: 2.78 million kL	15% of gasoline consumption: 6.28 million kL
Bio oil		
Biokerosene	Utilisation of 1.8 million kL	Utilisation of 4.7 million kL
Electricity generation	Utilisation of 0.74 million kL	Utilisation of 1.69 million kL
Biofuel	Biofuel utilisation for 3% of energy mix: 9.84 million kL	Biofuel utilisation for 5% of energy mix: 22.26 million kL

Note: kL = kilolitre.

Source: Information provided in 2014 from the Directorate of New Renewable Energy and Energy Conservation.

In September 2013, the government announced new subsidies for transport biofuels. Prices were set for bioethanol at IDR 3 500 per litre and biodiesel at IDR 3 000 per litre. The subsidised volume is capped at 48 million kL and 51 million kL, respectively. In addition, Ministry Regulation No. 25 of 2013 introduced new mandatory targets for biofuel blending, and the government aims to increase the blending ratio from 10% in 2014, to 20% in 2016 and 25% in 2025.

Biogas, biomass and waste energy

Current capacity of on-grid biomass power plants in 2013 was 90.5 MW, mainly located in Sumatra Island (Northern Sumatra and Riau), Bali, West Java and Kalimantan. Biomass power plant feedstock in Indonesia is mainly comprised of palm oil residues, municipal solid waste, sugar residues and other solid biomass, such as rice residues, rubber wood and wood chip. Smaller quantities are available from other agricultural waste, such as logging residues, sawn-timber residues and coconut residues.

Another potential source of biomass energy is municipal solid waste. According to the Jakarta Development Planning Agency, the city of Jakarta produces some 8 000 tonnes of waste per day, an amount that is growing rapidly. Waste management regulation is not yet in place, and currently waste is either burnt by households, collected by the municipality and dumped into designated dumping ground or landfill, or is informally dumped.

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With regard to biomass, biogas and organic waste material, the government has implemented incentives for electricity production. The government has set FiTs for biomass and biogas from agricultural products, sanitary landfill without residual waste products, and sanitary landfill with residual waste products (Table 8.5).

Table 8.5 FiT for bioenergy-based power plant

No.	Energy	Capacity	Electricity tariff	Note
Medium voltage				
1.	Biomass	up to 10 MW	IDR 975/kWh x F*	
2.	Biogas	up to 10 MW	IDR 975/kWh x F*	Non-municipal solid waste
3.	MSW	up to 10 MW	IDR 1 450/kWh	Zero waste
4.	MSW	up to 10 MW	IDR 1 250/kWh	Sanitary landfill
Low voltage				
1.	Biomass	up to 10 MW	IDR 1 325/kWh x F*	
2.	Biogas	up to 10 MW	IDR 1 325/kWh x F*	Non-municipal solid waste
3.	MSW	up to 10 MW	IDR 1 798/kWh	Zero waste
4.	MSW	up to 10 MW	IDR 1 598/kWh	Sanitary landfill

Note: MSW = municipal solid waste.

* F is the incentive factor based on the region where the power plant located, as follows: Java F = 1; Sumatera F = 1.15; Sulawesi F = 1.25; Kalimantan F = 1.3; Bali, Bang Belitung, Lombok F = 1.5; Kepri, papua dan other island F = 1.6.

Source: MEMR Regulations No. 4 of 2012 and No. 19 of 2013.

Finally, concerns over deforestation and land management policy related to palm oil production in Indonesia are becoming more important with the increase in bioenergy sources. Indonesia has started to address such issues and is a member of the Roundtable on Sustainable Palm Oil, which develops standards for sustainable palm oil production and consists of representatives from the government, industry and civil society. In parallel, the government together with national palm oil producers developed the national standard on palm oil production (ISPO) to address issues concerning sustainability.

WIND ENERGY

Onshore wind power has limited potential for development in Indonesia. With average wind speeds between 3 metres per second (m/s) and 6 m/s, wind power generators suitable for Indonesia are small (up to 10 kW) and medium-sized capacity (10 kW to 100 kW). In addition, Indonesia's most productive wind sites are located far from population centres, and would therefore require extensive transmission infrastructure.

Indonesia has constructed 12 wind farms across the country, each with a capacity of 80 kW, located in North Sulawesi, the Pacific Islands, Selayar Island and Nusa Penida, and Bali. Indonesia aims to reach a target of total installed wind capacity of 970 MW by 2025. The average cost of wind power is estimated to be approximately IDR 30 million (USD 3 250) per installed kW.

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SOLAR ENERGY

Given Indonesia's excellent resources, underdeveloped grid and a need for electrification on remote islands, distributed and off-grid solar photovoltaic (PV) applications have significant potential. As an equatorial country, it has an average solar radiation of 4.8 kWh per square metre per day. Such applications can play an important role in replacing relatively costly diesel-fired generation in remote areas.

To date, most of Indonesia's solar PV development has consisted of small and medium-sized off-grid systems. Between 2010 and 2011, the government constructed more than 100 PV systems with a total capacity of 80 MW in more than 100 locations and islands. Subsequently, the government set a national target of approximately 1 000 megawatts peak (MWp) installed PV capacity by 2025, to be implemented mainly through the 1 000 Island Programme. This programme was started in 2013 and will run through to 2016.

In 2013, the government also introduced a new FiT awarded through competitive bidding, for solar PV systems, ranging from IDR 2 840/kWh (if imported systems are used) to IDR 3 480/kWh if the system has a 40% domestic component share. Still, a number of challenges remain to scale up solar PV deployment. Knowledge of solar PV technology remains nascent among local government authorities, enterprises and financial institutions. PV system costs remain relatively high compared to more developed markets and local supply chains require further development. Moreover, grid-connected applications may require upgrading of local low-voltage grids and planning co-ordination between PLN and regional entities can be a challenge Increased penetration of solar PV may also require adjustments to local power system operating and balancing procedures, particularly in the case of smaller islands with limited load profiles.

ASSESSMENT

Indonesia has a large and diversified potential for renewable energy, but so far only a small fraction has been developed. However, in light of increasing world oil prices, decreasing domestic oil production, increasing energy demand, and social and environmental considerations, Indonesia has prioritised the development of renewable energy sources and has formulated a set of ambitious targets for the various renewable technologies.

Indonesia's excellent resources, need for new power capacity to meet fast-growing demand, improved long-term renewable targets and attractive financial incentives should support a portfolio of renewable development. Still, significant challenges related to strengthening the grid, reducing non-economic barriers to development, and addressing the cost and availability of financing. Given the long lead times associated with hydropower and geothermal developments, in particular, delays in policy implementation could undermine the realisation of 2025 renewable targets.

Barriers to renewable energy project development

Government approval procedures, particularly those concerning land acquisition and land ownership, cause significant delays and often cancellation of renewable energy projects in Indonesia. For example, renewable energy project developers are required to receive several layers of approval at both national and regional levels of government. The involvement of many different government institutions adds to the difficult and complex approval process that stands in the way of efficient project development.

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Local governments have been given greater authority, including administration of project tenders, but they often lack the capacity to do so transparently. For example, the private sector has noted that project tenders are often worded poorly and are unclear in their requirements. In addition, such documents have been changed or reworded after being opened for tender, which signals a lack of transparency in project development and discourages competitive bidding. Project developers have also noted the inconsistency of various laws and regulations, and potential conflict between them at national and local levels. The national government is now assisting the local government to promote better tendering practices, although further capacity building is required.

To meet the government's long-term renewable goals, significant private sector investment will be required. Traditionally, PLN has benefited from right of first refusal for all new generation capacity, and investment opportunities passed on to private investors are often less financially attractive. To that extent, the FiT scheme serves as an important economic enhancement and a mechanism for project origination by IPPs. Still, financial incentives in Indonesia will need to be coupled with an increased availability of lower-cost financing and a reduction of non-economic barriers for projects to be attractive.

The lack of experience in private financing of (long-term) renewable energy projects remains hence a significant challenge for renewable project development. Access to finance for renewable energy projects, particularly to loans beyond a five-year period, does not yet exist in Indonesia. The underdevelopment of project finance for renewable energy projects adds to the lack of development in the sector.

Government support to improve investment conditions for local small and medium-sized enterprises can create a commercially viable and sustainable market for renewable energy technologies in competition with conventional energy sources. For example, strengthening microfinance institutions to improve private sector access to loans, micro credit and grants is necessary to support small-scale renewable energy projects.

Finally, Indonesia's underdeveloped grid, widespread location of resources across a large archipelago and poor interconnection make the integration of renewable generation a challenge. In general, grid planning and investment have been insufficient and transmission constraints have emerged related to the geographical mismatch between large-scale power supply and demand. Geothermal resources look better situated near demand areas, but project lead times tend to be relatively long.

Distributed and off-grid applications, such as bioenergy and solar PV, have significant potential, particularly on smaller islands. Still, the distribution network may requires upgrading the local low-voltage grid and local power system operating and balancing procedures may require adjustment in the face of rising solar PV deployment and limited load profiles. In the past, grid access has been a barrier to renewable integration given PLN's monopoly, though recent government regulations have increasingly obligated PLN to off-take electricity from IPPs. PLN is also implementing plans to facilitate grid connections for these plants as well as develop small-scale solar PV on the outer islands.

Subsidies and pricing of renewable energy

The level of financial incentives appears to be sufficient to push the development of renewable energy in Indonesia, but there are concerns that unless the government increases fixed and regulated end-user energy prices, the FiT system will become economically unsustainable.

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In 2010, the average end-user price was USD 0.07 per kWh, while the average FiT rate or the price at which PLN must purchase electricity was USD 0.10 per kWh. The price differential adds to PLN's financial burden and threatens the long-term sustainability of renewable energy development. To incentivise more renewable investment, the government will have to keep the FiT high enough, and yet unless it also increases end-user prices it will have to provide increasing subsidies to PLN to cover the deficit between electricity costs (both its own production costs and the price it pays to off-take electricity from IPPs) and revenues. In 2011, the subsidies paid to PLN were estimated at just over USD 8 billion and were still increasing. They are expected to consume 25% of the state budget in 2014. In 2013, however, the government started to raise electricity prices, with an expected increase in electricity tariffs for industry of up to 65% in 2014.

An additional barrier to the uptake of renewable energy technologies in Indonesia includes the impact of its highly subsidised fossil fuel prices. For example, coal-fired electricity generation from low-grade domestic resources can cost less than half that of renewable resources, and for PLN, coal is a far more economically attractive generation source. While PLN is obligated to off-take renewable generation from IPPs, the disparity between renewable generation costs and end-user prices could well force the utility to switch its own production to coal in order to reduce losses, which would ultimately undermine the government's renewable energy and emissions objectives.

The government should be commended for its efforts to shift policy within the last decade to accelerate the use of renewable energy and to stimulate economic growth using locally available energy sources. Indonesia is on the right track; however, the great challenge now is to implement, monitor and adjust support measures like FiTs, taxes and other incentives in a transparent and predictable manner. Moreover, the government needs to reduce non-economic barriers for renewable energy projects to attract the investment necessary to achieve the 2025 renewable energy targets.

RECOMMENDATIONS

The government of Indonesia should:

- *Improve policy co-ordination and implementation. Reduce time consuming licensing procedures for investors by intensifying and optimising co-ordination between local and central government. Establish a one-stop agency for investors or identify a single institution at government level that can act as the point of contact for investors.*
- *Reduce unnecessary regulations and harmonise regulations among ministries involved in renewable energy; develop one regulation for all renewable energy technologies with regard to FiTs, finance and financial incentives to improve clarity.*
- *Increase capacity building: develop education programmes for industry, universities and public administration on renewable energy and how to manage renewable energy projects, to improve knowledge about technology and management skills.*
- *Undertake a comprehensive study of overall renewable energy potential across Indonesia, in order to provide an inventory of renewable energy potential, its economic feasibility, and understand its macroeconomic impact.*
- *Analyse in a dedicated study how to increase private investment in small-scale biomass and geothermal projects up to 10 MW.*

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9. ENERGY EFFICIENCY

Key data (2012)

Energy supply per capita: 0.87 toe (IEA average: 4.6 toe), +12.6% since 2002

Energy intensity: 0.11 toe/USD 1 000 PPP (IEA average: 0.14 toe/USD 1 000 PPP), -25.6% since 2002

TFC: 159.7 Mtoe (oil 43.4%, electricity 9.4%, biofuels and waste 33.4%, natural gas 10.9%, coal 2.9%), +28.6% since 2002

Consumption by sector: residential 37% industry 30.5%, transport 27.6% commercial and other 4.9%

OVERVIEW

BACKGROUND

Indonesia is the largest consumer of energy in Southeast Asia, accounting for more than 36% of the region's energy demand. The country's energy consumption is forecast to increase by 7% per year, and growth in demand for energy can be seen in all sectors, with a notable increase in the transport sector. Indonesia is becoming increasingly dependent on fossil fuels for its national energy supply.

In 2010, Indonesia established the Directorate-General of New, Renewable Energy and Energy Conservation (DGNREEC) within the Ministry of Energy and Mineral Resources (MEMR), to facilitate the implementation of energy efficiency plans and programmes. When considering Indonesia's strong economic growth forecasts and corresponding expected increase in energy consumption, significant potential exists for its energy efficiency market as the government increases support for energy efficiency policies in the residential, industrial and transport sectors.

FINAL ENERGY USE

FINAL CONSUMPTION BY SECTOR AND BY SOURCE

Total final consumption (TFC) of energy was 159.7 million tonnes of oil-equivalent (Mtoe) (1 050 million barrels of oil-equivalent) in 2012. Energy consumption has increased by a total of 28.6% since 2002, increasing each consecutive year.

All sectors of the economy have increased their demand for energy (Figure 9.1). The largest energy consumer is the residential sector, which accounted for 37% of TFC in 2012. Industry accounted for 30.5% of TFC, while the transport and the commercial sectors consumed 27.6% and 4.9%, respectively. Over the decade since 2002, energy consumption in the transport sector has experienced the strongest growth at 85.6% in total. Industrial demand and demand from the commercial sector were 21.5% and 24.3%

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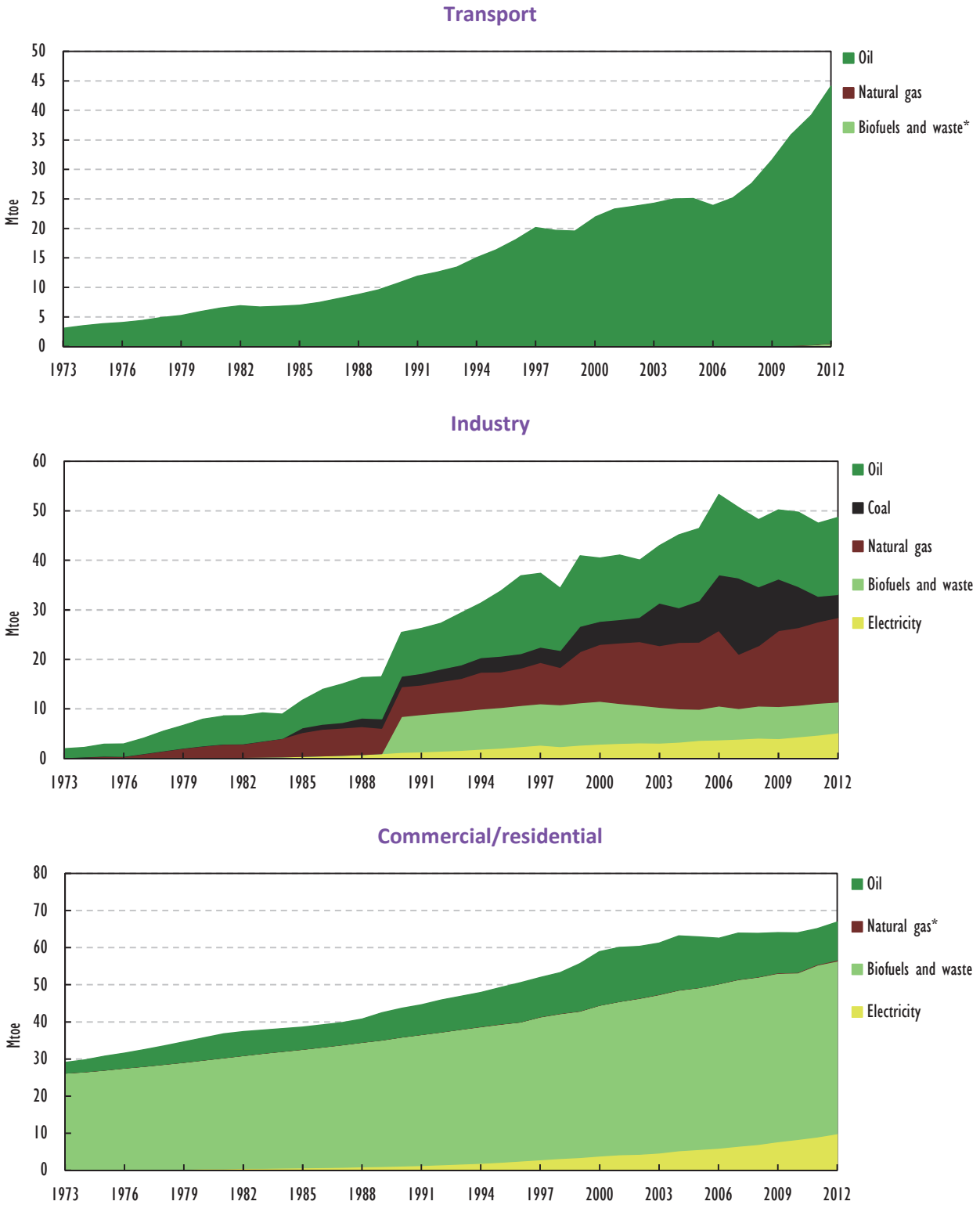
Figure 9.1 TFC by sector and by source, 1973-2012



* Negligible.

Source: IEA (2014a), *Energy Balances of Non-OECD Countries 2014*, OECD/IEA, Paris.

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higher in 2012 compared to 2002, while the increase in consumption by the residential sector was more subdued at 9.2%.

Oil, mainly used in transport and industry, is the most prominent fuel in final energy consumption in Indonesia, representing 43.4% of total use. Demand for oil has increased by 40.8% since 2002, which is slightly faster than the overall increase in TFC.

Bioenergy and waste account for a further 33.4% and are mainly used in the residential and commercial sectors. Bioenergy is mainly used in the transport, residential and commercial sectors.

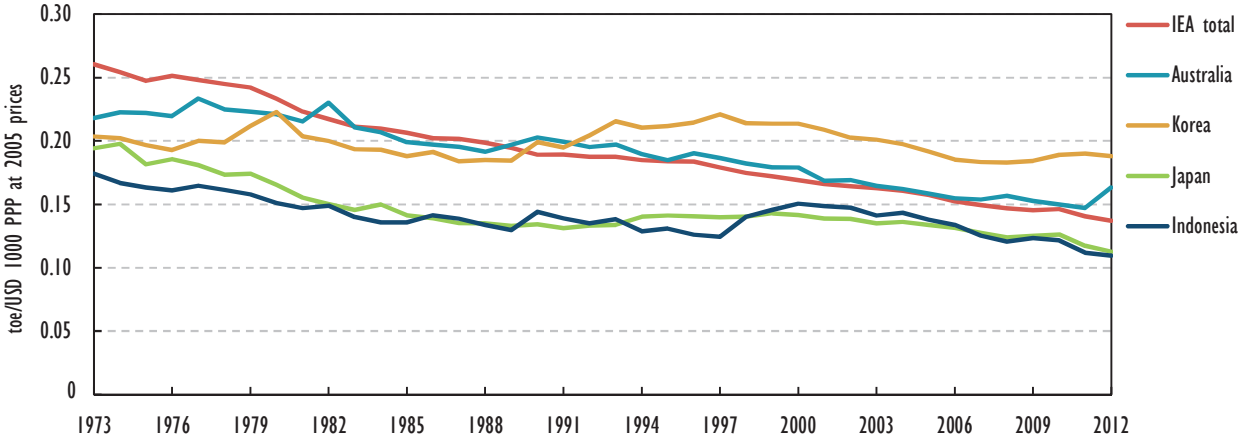
Natural gas and electricity represent 10.9% and 9.4% of TFC, respectively. Natural gas is used in the industrial sector, while electricity is equally consumed by the residential and commercial sectors. Electricity demand has more than doubled since 2002, while the increase in the use of gas was 34.1% over the same period. The share of coal in TFC is 2.9%, and demand for coal has declined by 4.9% during the decade. The industrial sector is the main consumer of coal.

ENERGY INTENSITY

Energy intensity, measured as energy supply per unit of gross domestic product (GDP), stood at 0.11 tonnes of oil-equivalent (toe) per thousand USD at purchasing power parity (PPP) in 2012, which is lower than the IEA average of 0.14 toe per USD 1 000 PPP. Over the ten years to 2012, intensity declined by 25.6% after an increase during the late 1990s (Figure 9.2).

Energy supply per capita, however, is lower than in any IEA member country. TPES per capita was 0.87 toe in 2012, behind Portugal which was the next lowest at 2.17 toe. Unlike energy intensity, the level of energy per capita has increased over time, up by 12.6% in 2012 compared to 2002.

Figure 9.2 Energy intensity in Indonesia and in selected IEA member countries, 1973-2012



Sources: IEA (2014a), *Energy Balances of Non-OECD Countries 2014*, OECD/IEA, Paris; IEA (2014b), *Energy Balances of OECD Countries 2014*, OECD/IEA, Paris.

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INSTITUTIONS

Following the recommendations of the last IEA *Energy Policy Review of Indonesia* (IEA, 2008), Indonesia established the DGNREEC within MEMR in 2010. The Directorate of Energy Conservation, one of four within DGNREEC, is responsible for establishing and co-ordinating interministerial energy efficiency policy and strategy, and the national energy conservation programme. The Directorate of Energy Conservation is also responsible for setting specific energy consumption (SEC) standards for buildings and offices, and also for updating compliance standards of the Indonesian National Standard (SNI), which has been established for lighting systems, air systems and building envelopes, among others.

Other ministries also have duties and responsibilities in establishing and implementing energy efficiency policy and standards:

The **National Standardisation Agency (BSN)** sets guidelines for SNI energy standards and labels.

The **Ministry of Industry (MoI)** establishes guidelines for implementation of energy conservation in the industrial sector. MoI is responsible for developing initiatives to increase industrial energy efficiency, as well as the manufacture of energy-efficient products.

The **Ministry of Public Works (MPW)** establishes regulations on the energy performance of buildings and guidelines to implement energy conservation in buildings. Such standards and benchmarks are based on SNI.

The **Ministry of Transport (MoT)** is responsible for developing initiatives for the national transport system and energy efficiency vehicles. It is also responsible for implementing energy-saving principles with regard to the planning, operation and management of the national transport system.

The **Ministry of Trade (MoTr)** establishes regulation for the oversight and promotion of energy-saving products. It aims to implement incentives for bringing such products onto the market.

The **Ministry of Finance (MoF)** allocates funding for energy conservation as part of the national budget. It works across all sectors and at national and regional government levels.

The **National Development Planning Agency (BAPPENAS)** is responsible for incorporating energy efficiency and conservation guidelines into the national development plan. BAPPENAS also creates planning guidelines for energy-efficient projects at national and regional levels.

The **Ministry of Research and Technology**, which also manages the **Agency for Assessment and Application of Technology (BPPT)**, is responsible for disseminating information on energy-saving technology, as well as developing initiatives to demonstrate energy-saving processes, technology and devices.

Regional and local governments are responsible for developing regulations that support energy conservation in industry and business. Furthermore, sub-national governments provide incentives and awards for achieving success in energy conservation measures, and disseminate information on energy efficiency at the local level.

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POLICIES AND MEASURES

Energy Law No. 30 of 2007 is the foundation for energy policy making. It mandates the government to establish the National Master Plan on Energy, which is the basis for the Master Plan for National Energy Conservation (RIKEN). A draft version of the RIKEN is awaiting approval. This master plan will include energy-saving targets for all sectors to be met by 2025 through the implementation of energy conservation measures (Table 9.1).

In the current draft master plan, Indonesia aims to reach energy savings of 17% in the final consumption of the following sectors by 2025:

- industrial sector, 17%
- transport sector, 20%
- commercial sector and households, 15%.

Furthermore, Indonesia is targeting a 1% energy savings in the transformation sector by 2025 with the following:

- electricity production, 0.5%
- transmission, distribution and refineries, 0.25%.

The energy savings target of 17% is based on a business-as-usual scenario with an average annual growth of energy demand of 7.1% per year. In addition, there is a target to decrease energy intensity by 1% each year and also to improve energy elasticity.

Table 9.1 Indonesia energy savings potential by sector

Sector	Energy consumption 2011 (million boe)	Energy conservation potential	Energy conservation target 2025
Industry	316 (43%)	10-30%	17%
Commercial	32 (4%)	10-30%	15%
Transport	279 (38%)	15-35%	20%
Households	85 (12%)	15-30%	15%
Other	25 (3%)	25%	X

Note: X = not applicable.

Source: Directorate-General of New and Renewable Energy and Energy Conservation (2011), *Draft National Energy Conservation Master Plan (RIKEN) 2011*, Ministry of Energy and Mineral Resources, Jakarta.

The Energy Law is also the basis for many governmental and ministerial regulations, including Government Regulation No. 70 of 2009 on Energy Conservation, Ministry Regulation No. 14 of 2012 on Energy Management in Industry, and Ministry Regulation No. 13 of 2012 on Electricity Savings in Public Buildings and Street Lighting. On a national level, Presidential Instruction No. 13 of 2011 on Water and Energy Savings requires national, regional and local governments, as well as state-owned companies, to implement energy- and water-saving measures with the goal of achieving electricity savings of 20%, water savings of 10%, and fuel savings of 10%.

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SECTOR POLICIES

BUILDINGS SECTOR

Indonesia has significant energy efficiency potential in both the residential and commercial sectors. Most regulations regarding building design are determined by the MPW. Such regulations follow energy efficiency measures as outlined by the MEMR, which is currently drafting building codes for the establishment of SEC standards for buildings and offices.

The SNI on Energy Conservation in Building Envelopes was established to regulate and limit the overall thermal transfer value of buildings. This national standard is currently voluntary for all new buildings and buildings undergoing substantial renovation or alteration. In the case of Jakarta, however, the Governor of Jakarta has passed Regulation No. 38 of 2012 concerning Green Buildings, which sets mandatory energy efficiency requirements and energy use consumption standards for large buildings. This regulation prevents and restricts buildings that fail to meet these standards from receiving necessary building permits. As in the case of Jakarta, the government aims to continue pushing building developers and owners to comply with the SNI as Indonesia strives towards standardisation of new and existing buildings.

Energy efficiency levels currently achieved in the buildings sector are largely uncertain, as energy performance labels or certificates are not required for owners, buyers or renters. Furthermore, at present, tax credits are not available to provide an incentive to meet standards set out in regulation.

APPLIANCE SECTOR

Households are the largest consumer of electricity in Indonesia. Household electricity demand is being driven by growth in the number of households and the greater adoption of appliances resulting from a rise in living standards in urban areas. Given the potential for improved energy efficiency in appliances, Indonesia is currently developing minimum energy performance standards (MEPS) as mandated in Government Regulation No. 30. Furthermore, BSN is developing energy standards and labels for application on a variety of appliance categories. Regulations for compact fluorescent lamps are the first in place, while standards are being developed for refrigerators, air conditioners and other appliances (Table 9.2).

Table 9.2 Appliance standards and labels under development in Indonesia

	Product	SNI energy performance testing standards
1.	Ballast (magnetic)	SNI IEC 60929-2009
2.	Fluorescent lamp	SNI IEC 60901-2009
3.	Incandescent lamp	SNI IEC 60432-1-2009
4.	Room air conditioner – split type	ISO* 5151
5.	Room air conditioner – window type	ISO 5151
6.	Household refrigerator	SNI IEC 15502-2009
7.	Clothes dryer	SNI IEC 60456-2009
8.	Electric iron	SNI IEC 60311-2000
9.	Vacuum cleaner	SNI IEC 60312-2009

Source: IEA, Indonesia Questionnaire, 2014.

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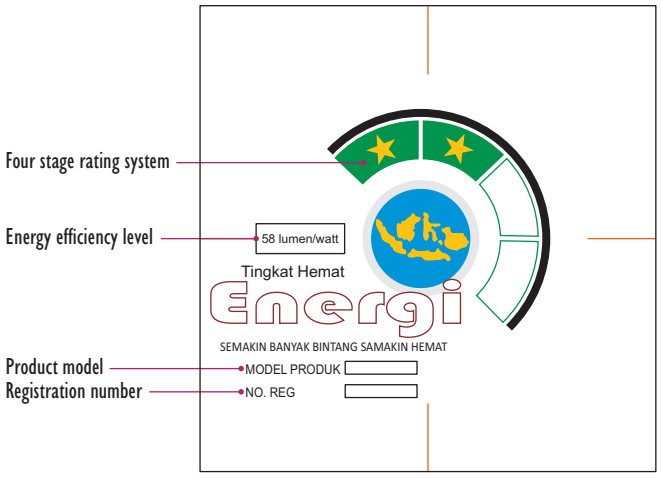
In addition, through the government's Energy Efficiency Standards and Labels for Electronic Appliances Programme, Indonesia is to develop a labelling scheme for electronic products. The labels will help the market recognise and compare between similar products by indicating a product's energy performance and efficiency. The labels will show the energy efficiency rating on a scale of 1 to 4 stars, more stars being more efficient (Figure 9.3). This programme will also encourage local manufacturers to improve the energy efficiency of their products. The government has recognised, however, that the availability of testing laboratory facilities, as well as the capacity of local manufacturers, remains relatively limited in Indonesia (Government of Indonesia, 2014).

Figure 9.3 Proposed energy efficiency label in Indonesia



Source: Indonesia Directorate of Energy Efficiency, MEMR.

INDUSTRIAL SECTOR

Industry is the largest energy-consuming sector in Indonesia, accounting for approximately 44% of all energy consumption (APERC, 2012). The government recognises the great potential for energy efficiency in this sector.

Government Regulation No. 70 of 2009 on energy conservation allows for the establishment of a series of fiscal incentives to promote energy efficiency among industrial energy users, although they have yet to be introduced. The regulation outlines mandatory audits and public reporting on energy efficiency, which are aligned with international best practice. Indonesia aims to implement energy management practices for sectors where energy use is greater than 6 000 toe or 70 gigawatt hours per year. More specifically, regulation of MEPS for industrial equipment and the adoption of international standards are in the process of being introduced. Major industries with strong energy efficiency potential in Indonesia include textiles, iron and steel.

Since 2012, through the support of the United Nations Industrial Development Organization (UNIDO) and the Global Environment Facility, MEMR and MoI, along with BSN, have been working to adopt energy management and system optimisation standards for industrial sectors based on the ISO 50001 energy management system. The various government stakeholders will also support capacity building and expert training for companies, particularly in the pulp paper, chemical, food and beverage, and textile industries.

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Implementation of such energy efficiency measures among industrial energy consumers has been difficult, partly due to the lack of accessible finance and fiscal incentive measures. Furthermore, most implementation initiatives have started only on an ad hoc basis.

TRANSPORT SECTOR

The growth of the transport industry offers great potential for energy efficiency measures in Indonesia. In particular, the country's increasing population and economic growth is linked to an increase in motor vehicle ownership, which, combined with rapid urbanisation, is leading to greater traffic congestion. Motorcycles account for 80% of the country's private transport vehicles, and the modal share of motorcycles is increasing at the expense of public transport. Indonesia places no fuel efficiency or emissions restrictions on the light vehicle fleet at present. Bus lanes suffer from a lack of enforcement, which is undermining the potential development of effective high-capacity bus rapid transit systems. Furthermore, plans for metro, monorail and railway systems are experiencing delays. Similarly, delays in the development of rail projects are creating challenges for the implementation of policy aims to shift road freight traffic to rail. A double-track project connecting Indonesia's two biggest cities, Jakarta and Surabaya, however, has been completed.

The government has identified five pillars for energy conservation in transport: an expanded public transport system; transport demand management; non-motorised transport; traffic control management; and decreasing air pollution. Transport Ministerial Regulation No. 201 of 2013 aims to mitigate greenhouse gas emissions through fuel substitution from oil to gas, as well as car-free days on weekends, transit-oriented development planning, and encouragement of the use of non-motorised vehicles. Road pricing and parking management are not yet actively implemented in Indonesia.

CROSS-SECTORAL

Given the great potential for energy savings, Indonesia is seeking to increase investment in energy management measures across business sectors. The government is drafting regulation and policy to manage and control funding mechanisms such as energy services company development. Funding schemes for energy efficiency projects, such as asset-based lending, are also needed to support implementation, particularly within the buildings and industrial sectors.

Indonesia's financial institutions currently lack familiarity with the cost-benefit rationale for energy efficiency projects. For example, results from the Energy Conservation Partnership Program, a government-supported programme in Indonesia, have shown the difficulty companies face in investing in energy-saving measures. The programme was conducted with companies who voluntarily committed to participating in energy audits and regular monitoring for three years, in order to review progress on implementation of energy audit recommendations. Results from the programme revealed that companies mostly implemented only "no-cost" or "low-cost" recommendations. Companies had limited budgets for implementation of energy audit recommendations, particularly for medium and high cost recommendations. Companies also lacked data on energy efficiency costs, which contributed to a lack of commitment to implementation.

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From the Energy Conservation Partnership Program, the government has identified mitigation measures to overcome barriers to implementation of energy efficiency measures across sectors through:

- the development of financial schemes to increase higher impact (higher cost) investment among companies in Indonesia
- capacity building for financial institutions to develop their understanding of energy efficiency cost-benefit analysis
- implementation of energy efficiency pilot projects among companies in order to develop best practice examples within Indonesia.

ASSESSMENT

Government co-ordination

Although Indonesia has made considerable regulatory progress on energy efficiency measures in recent years, progress is hindered by several different ministries having duties and responsibilities for energy efficiency that are key to implementing standards and promoting financial support. In addition to the Directorate of Energy Conservation within MEMR, these include the MoI, the MoT, BAPPENAS, and the MoF among several others, meaning that strong co-ordination is needed to develop, implement and monitor regulatory measures. At present, co-ordination within and between ministries could be improved. The establishment of a single implementation authority would prove helpful for improving implementation of energy efficiency measures in Indonesia.

Policy implementation and enforcement

Important regulations in support of energy conservation and efficiency have helped to build a foundation for energy management across energy-related sectors in Indonesia. For example, energy labelling of appliances has started and there are signs of an infant energy services contracting business. Nonetheless, general awareness of the benefits of energy efficiency and conservation measures seems low. In general, a greater focus on energy supply than on energy demand issues is apparent, although this is often the case in many countries.

Enforcement of regulatory measures and standards set by legislation has been insufficient. For example, Presidential Instruction No. 13 of 2011 on water and energy savings instructs national, regional and local governments, as well as state-owned companies, to implement energy- and water-saving measures to achieve electricity savings of 20%, water savings of 10%, and fuel savings of 10%. Enforcement of the Presidential Instruction, however, is reported to be weak and should be strengthened.

Special task forces for energy efficiency should be set up within each organisation and a national team for energy and water savings should be established and regularly report on progress. In another example, the enforcement of building codes is weak, which is indicative of Indonesia's general challenge in implementing and enforcing laws and regulations. The difficulty in implementing measures also signals a need for greater co-ordination between the member ministries of the National Energy Council and the Directorate for Energy Conservation.

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While Indonesia's development of important energy efficiency standards and guidelines is commendable, implementation has seen slow progress. For example, with regard to regulation on energy management, companies are required to appoint energy managers, perform energy audits, introduce energy management programmes, and report energy management activities to the appropriate government agencies. At present, however, companies place limited focus on energy efficiency measures, as the benefits are not well understood or not seen as sufficient incentive for action. Efficiency measures are not prioritised compared to other investments. The government should be encouraged to take a leading role, showcase best practice, and engage in capacity building and dissemination activities to increase energy efficiency awareness among companies.

The government should conduct further analysis of energy-efficient investments, as the evaluation of financial incentives could provide an excellent basis to improve understanding of the benefits of energy efficiency measures. This could kick-start implementation and investment. Macro-level economic analysis of the effectiveness of these policies could demonstrate the benefits of energy efficiency gains in the economy. Improvements in data gathering and monitoring of energy conservation and efficiency activities, particularly with regard to meeting targets and enforcing standards, should be made to allow measurement of implementation and national progress on energy efficiency in Indonesia. The availability of data needs to be strengthened, and the recommendation of the last IEA *Energy Policy Review of Indonesia* (IEA, 2008) to increase the capacity of PUSDATIN to generate end-use statistics still remains.

Impact of subsidies

The principal obstacle to energy efficiency and conservation policies in Indonesia is the subsidies on fossil fuels and electricity. The increase in tariffs and fuel prices through subsidy reform should be helpful in curbing the growing energy demand, while not necessarily impeding economic growth. Energy efficiency is central to these ambitions and should be placed higher on the energy agenda, especially since investments in supply and transformation are coming online at a slower pace than expected in government projections of energy demand. Other barriers include low public and professional awareness of the benefits of energy efficiency measures, and limited experience in financial institutions and public procurement.

RECOMMENDATIONS

The government of Indonesia should:

- *Prioritise energy efficiency, for example by increasing state funding and public awareness of the benefits. Instruct government institutions and all state-owned enterprises to implement energy efficiency policies and regulations.*
- *Enforce, monitor and evaluate energy efficiency and conservation policies and regulations, including the evaluation of long-term aspirational goals. This requires the gathering and organisation of end-use data, development of energy efficiency indicators, and investigation of little-studied applications such as co- and tri-generation.*
- *Facilitate the energy services market and energy service contracting opportunities, and make available funds for energy efficiency investments based on cost-benefit*

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analysis. The financial institutions of Indonesia should be made aware of the nature of energy efficiency investments and the government should review its public procurement practices to facilitate public spending on energy efficiency.

- *With regard to available resources, engage further in international collaboration on best practice, policies and technologies for energy efficiency and conservation measures.*

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10. TRANSPORT

Key data (2012)

Share of Transport in TFC: 44.1 Mtoe (27.6%)

Domestic automotive production: 1 208 211 vehicles in 2013

Domestic automotive sales: 1 229 901 vehicles in 2013

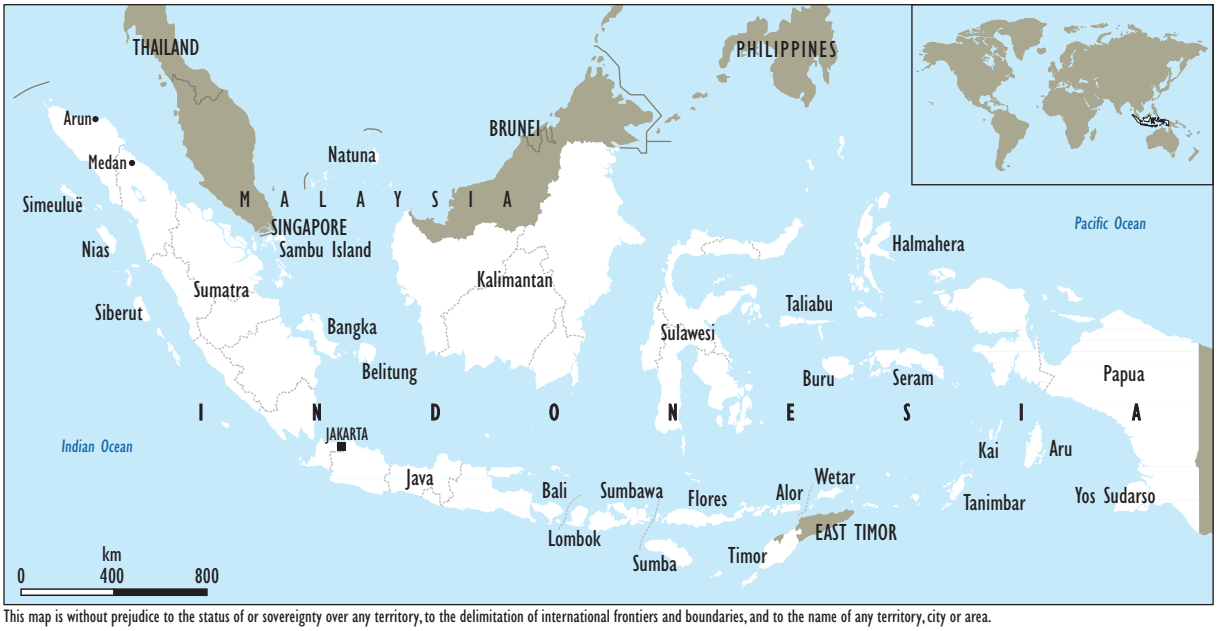
Sources: World Bank, Gaikindo, IEA Statistics.

OVERVIEW

BACKGROUND

Indonesia's transport sector is defined by the spread-out nature of its archipelagic geography (Figure 10.1). The country is urbanising and its population is increasing, as are sales of motor vehicles. These trends are converging to cause crippling congestion in the cities, especially in the country's capital of Jakarta. Gross domestic product (GDP) per capita is expected to rise by approximately 60% by 2020, with higher car ownership implied (EIU, 2014). Moreover, fuel prices are heavily subsidised, a policy which hurts Indonesia's government receipts and creates disincentives for efficiency.

Figure 10.1 Map of Indonesia



This map is 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.

Indonesia's increasing population and prosperity are correlated with higher rates of motor vehicle ownership, which, alongside rapid urbanisation, are increasing congestion.

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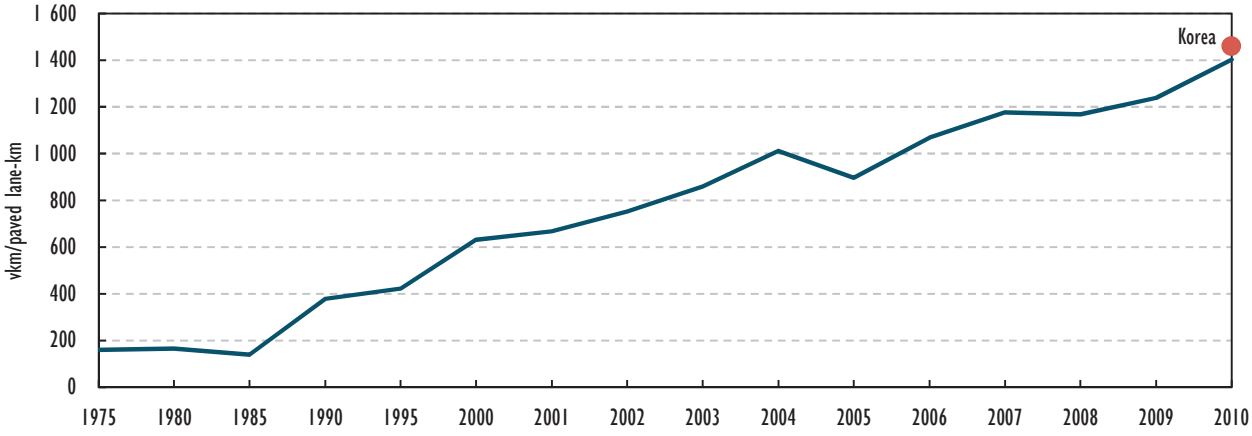
Only by increasing infrastructure spending will Indonesia's cities thrive rather than suffer from local air pollution and congestion, which is increasing so fast that Jakarta nears complete gridlock according to Japanese research agency ITPS. Central government budgets for core infrastructure including roads, electricity and water are currently just one-third that of fuel subsidies. Transport infrastructure spending specifically needs to grow to support mass transit and non-motorised travel (NMT).

The government is aware of these challenges and has responded by prioritising four transport policies:

- to increase usage of compressed natural gas (CNG) in vehicles, with research and development focused on mass production of converter kits and development of CNG infrastructure
- to promote affordable energy-saving cars, which are smaller, typically domestically produced cars that bring with them the downside of increasing congestion, as they can enter previously un-motorised areas
- to improve the ability of gasoline and diesel engines to handle higher biofuel content
- to develop public transport and traffic management.

Building on previous International Energy Agency (IEA) analysis (Dulac, 2013), Indonesia's road occupancy (measured as vehicle kilometres [vkm] per paved lane kilometre [km]) is the second highest in the world, almost overtaking Korea (Figure 10.2). This is not a perfect measure of congestion, but it is indicative of vehicle growth outpacing addition to infrastructure.

Figure 10.2 Indonesia road occupancy level, 1975-2010



The result of this imbalance and the lack of spending on efficient mass transit infrastructure is that one-third of Indonesian fuel use is wasted in stationary traffic, and average speeds continue to decrease unabated across all major Indonesian cities. Bus lanes suffer from a lack of enforcement, which undermines their potential to become high-capacity bus rapid transit (BRT) systems.

The transport sector accounted for approximately 33% of final energy consumption in 2011 (Table 10.1) and for 96% of subsidised fuel consumption.

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Table 10.1 Transport's share of TFC, 2000-12

Year	Share of transport
2000	18.0%
2005	18.6%
2010	24.0%
2011	25.8%
2012	27.6%

INSTITUTIONAL FRAMEWORK

Indonesia has committed to reducing greenhouse gas (GHG) emissions by 26% from a business-as-usual scenario by 2020, or 41% with international support. Transport is considered one of seven key emission reduction areas, accounting for more than 50% of oil consumption and 30% of energy-related emissions, and growing at a faster rate than any other demand sector. Presidential Decree No 61 of 2011 on a National Action Plan on GHG Emissions Reduction (RAN GRK) sets out how this will be done. In relation to transport, Transport Ministerial Regulation No. 201 of 2013 on a National Action Plan on GHG Emissions Reduction in the Transport Sector employs an *Avoid*, *Shift* and *Improve* approach.

MEASURES AND STRATEGIES FOR SUSTAINABLE TRANSPORT

The government of Indonesia has implemented a range of measures to achieve a sustainable transport sector:

- Air quality monitoring
- NMT:
  - Integrating land use and transport planning to enable walking and cycling to commercial area.
  - Major developments are now considering transit-oriented development (TOD) and job-housing balance or co-location, as well as promotion of low-cost multi-storey housing to reduce commuting distances.
  - *Car-Free Day* is an initiative by local governments to decrease air pollution and promote pedestrian space. It is often held on Sunday mornings, and in some cities the street space is divided into sport, education, art and culture, and entertainment areas.
- Road-to-rail:
  - To relieve road transport, the government is aiming to double-track the 727 km rail line from Jakarta to Surabaya, connecting Indonesia's two largest cities and increasing frequency and capacity by 200% to 300%.
- Nationally Appropriate Mitigation Actions (NAMAs):
  - A NAMAs facility has been funded by the United Kingdom and Germany and was accepted at COP19 in Warsaw in 2013, covering land, sea, air and rail transport. The government of Indonesia has already received USD 14 million from Germany and the United Kingdom towards this initiative.

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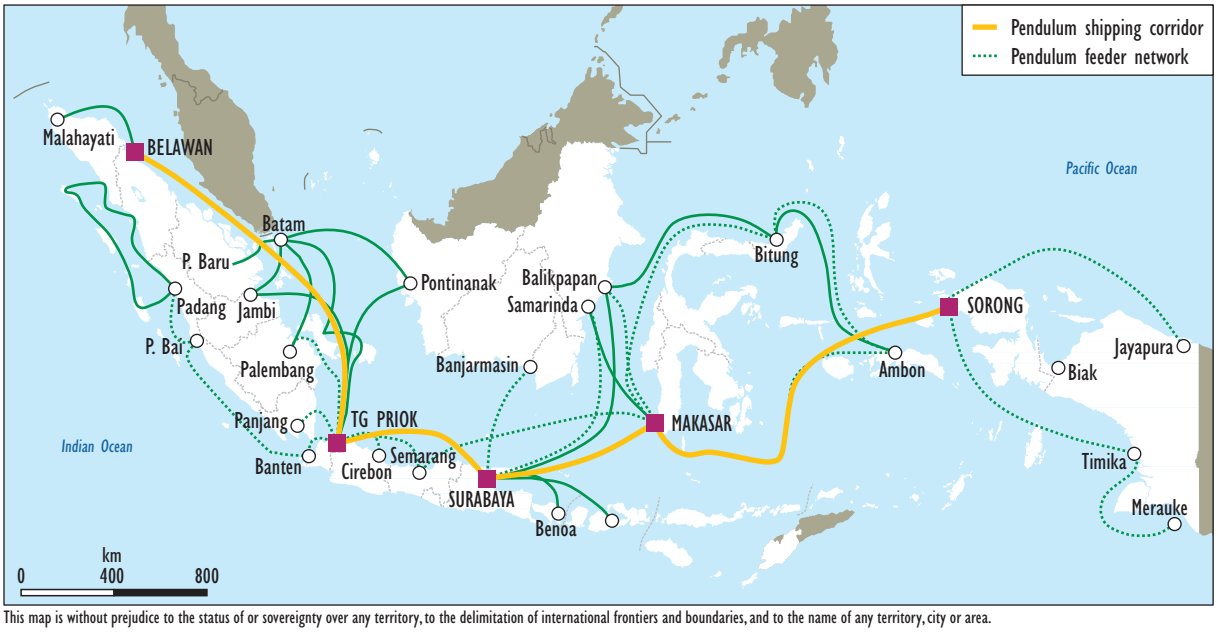
- The Sustainable Urban Transport Program (NAMA SUTRI) addresses urban transport through the following technologies: public transport system improvements including system reform, network management and operation, energy-efficient vehicles, infrastructure (bus stops, pedestrian walkways, parking meters), integrated planning, parking management, informal bus system and private vehicle regulation.

- Gasification of public transport, including:
  - Conversion of buses to run on natural gas and distribution of 2 575 converter kits for taxis in Jakarta City.
  - 1 667 converter kits for para-transit in Palembang and Bogor City.
  - 450 converter kits for para-transit in Surabaya City.
- Efficient sea transport:
  - Modernising information and data systems, including domestic ports and manifests, enabling better navigation services.
  - The Pendulum Nusantara (Figure 10.3), forming a seaway corridor connecting Indonesia through the six main ports of Belawan, Batam, Jakarta, Surabaya, Makassar and Sorong.

Figure 10.3 Proposed Indonesian seaway corridor



This map is 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.

Source: government of Indonesia.

- Intelligent Transport Systems (ITS):
  - increased traffic information on a central website
  - mobile traffic information through apps
  - mobile application for taxi services
  - area traffic control systems

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- parking information systems (usually in metropolitan malls)
- closed-circuit television cameras and variable message signs (toll roads)
- carpooling service (known as Nebengers) with 2 200 members, which started in December 2011.

- BRT:
  - Currently 15 major cities operate BRT in Indonesia, the first becoming operational in 2004, and by 2020 every major city is aiming to develop its own mass transit (metro, light rail or BRT).

Table 10.2 List of BRT and transit programmes in Indonesia

City	Programme name
Jakarta	Trans Jakarta
Batam	Bus Pilot Project
Bogor	Trans Pakuan
Yogyakarta	Trans Jogja
Semarang	Trans Semarang
Pekanbaru	Trans Metro
Bandung	Trans Metro Bandung
Manado	Trans Kawanua
Gorontalo	Trans Hulontalangi
Palembang	Trans Musi
Solo	Batik Solo Trans
Sarbagita	Trans Sarbagita
Ambon	Trans Amboina
Tangerang	Trans Jabodetabek

Source: Ministry of Transport of Indonesia.

- Sustainable airports:
  - Indonesia is developing an *Eco Airport* with Jakarta's Soekarno-Hatta Airport as the first example of an airport where operations and management follow the principles of sustainable development, including installation of renewable energy, e.g. solar energy. The initiative entails protecting the environment and surrounding communities from the negative impacts caused by airport operations. Airports are also required to use the best available technology to avoid or mitigate negative impacts of airport operations.

- Aviation biofuel and renewable energy:
  - Biofuels are used for aircraft in accordance with International Civil Aviation Organization (ICAO) guidelines.
  - Studies are being conducted on biofuel research related to production, distribution, supply, sustainability, safety, aviation security and risk management.

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INTER-URBAN TRANSPORT

According to the latest origin-destination survey implemented by the government of Indonesia, 81% of total national freight movement originated in Java, and 70% of that was intra-Java movement. Public shipping is yet to become fully compliant with International Maritime Organization (IMO) safety standards. Similarly, enhancing the availability of intra- and intermodal transport would be beneficial to this nation of islands.

A major stumbling block for the export of coal is the lack of reliable roads. Even when plans are developed to construct roads suitable for coal trucks, local opposition hinders construction. Opposition stems from the damage coal traffic causes to roads, as well as safety, health, environmental and congestion concerns.

Rail would be a preferable way to increase exports and decrease road congestion. Plans exist to double-track 230 km of railway line on Sumatra and 422 km on Kalimantan, but neither has reached fruition due to ongoing delays. Only the Java track is currently in the process of being double-tracked, which will help increase freight capacity. Work is under way to improve a 40 km commuter railway in Bandung, which is being double-tracked and electrified as part of a support project by the French Agency for Development (AFD).

Inter-urban rail is not widely supported outside Java and Sumatra, and the two island rail networks are yet to be double-tracked, linked together or electrified. In total Indonesia has 6 535 km of rail track as of 2013, although only 4 733 km are classified as "operational". Only Jakarta's commuter rail is electrified.

URBAN TRANSPORT

Greater Jakarta (known as *Jabodetabek*) has a population of 28 million (11% of the national population), and central Jakarta has a population of 10 million. Indonesia is already 50% urbanised, and is expected to be 72% urbanised by 2050 (Clean Air Asia, 2014) (Figure 10.4). Estimates predict Java alone to have 100 million people by 2025. The islands of Java and Sumatra account for 80% of GDP and 79% of the country's population, with both expected to increase rapidly.

A total of 11.3 million vehicles are used each working day in Greater Jakarta (Jakarta Post, 2011). Including externalities, the cost of congestion per year in Jakarta amounts to IDR 42.9 billion, or IDR 17.4 billion without externalities (Monocle Magazine, 2014). For comparison, the infrastructure budget for Greater Jakarta was IDR 72 trillion, which happens to be almost exactly equal to its spending on fossil fuel subsidies.

A study from 2009 found that the average vehicle speed in Jakarta fell from 38 kilometres per hour (km/h) in 1995 to 17 km/h in 2007 due to congestion, with fuel wasted amounting to one-third of overall consumption (ITPS, 2014). The potential to alleviate congestion through road pricing has to date received scant attention.

Congestion also needs to be tackled by promoting other modes of transport such as NMT, including walking and bicycling. Given that only 6% of Jakarta's roads currently have sidewalks, much can be done to promote NMT.

Greater Jakarta, with a population of 28 million, may be the largest city in the world without a rapid transit system, with the TransJakarta Busway being the one exception.

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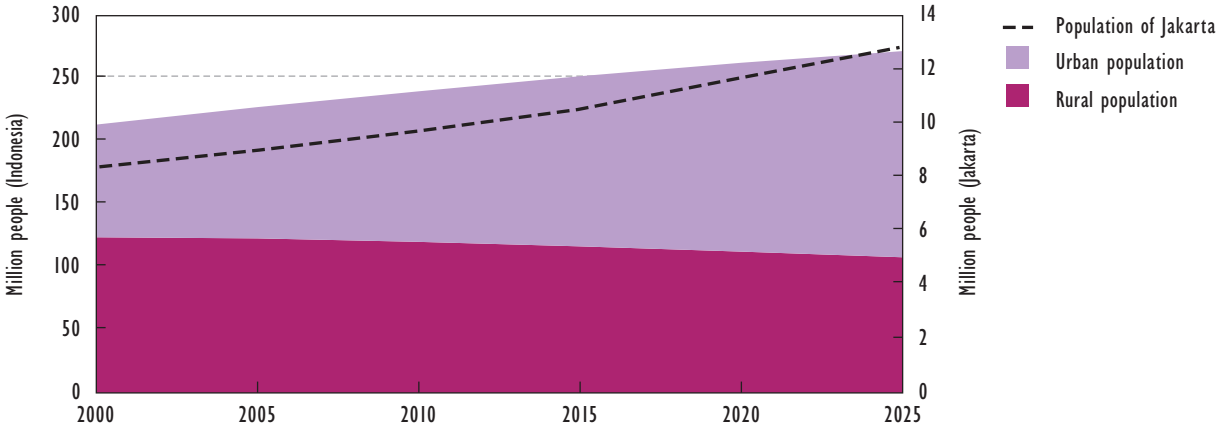
This, however, is not a fully-fledged BRT system, despite carrying 400 000 people per day.[1] Indonesia has 14 busway systems, all at various stages of upgrading to full BRT.

Figure 10.4 Expansion of the urban population in Indonesia, 2000-25



Source: OECD (2013), *Economic Outlook for Southeast Asia, China and India 2014: Beyond the Middle-Income Trap*, OECD Publishing, Paris, http://dx.doi.org/10.1787/saeo-2014-en.

The last *Energy Policy Review of Indonesia* (IEA, 2008) recommended that greater efforts be made on BRT and rail. Solid progress on right-of-way busways has been made, and plans for metro and monorail systems have attracted financing, but delays in implementation are threatening these projects and scaring investors away from others. Indonesia's plans to develop its rail network have largely been delayed, and progress needs to be accelerated to effectively overtake increasing rates of congestion.

Encouragingly, Jakarta's administration, central government and a private investor consortium have joined together to invest USD 4 billion in transport infrastructure, comprising a metro system with both subway and above-ground components linking south and central Jakarta; two monorail projects; an airport express train; and an elevated circle line train. The 15.7 km subway was projected for completion by 2016, although this has now been delayed to 2018. The project originally began in 2005, but land acquisition has proved difficult.

Regarding BRT, Indonesia has collaborated with international partners on sharing best practice, but analytical capacity needs to be developed to better understand performance across the 15 BRT systems planned to be in operation by 2020. Furthermore, the government of Indonesia needs to strengthen enforcement of segregated busways, promote compliance with traffic regulations through public outreach, support regulation to expedite land acquisition and permitting for transport projects, as well as streamline departments so that transport projects are integrated in planning and execution, and cheap and safe public transport becomes a reality.

Plans exist in Jakarta to integrate land use and transport planning, but implementation is the recurring issue. A master plan for urban and transport planning exists at the local level, but permits and land acquisition are handled by a different agency. Implementation thus remains a key hurdle, as does a lack of traffic enforcement, which needs to be tackled through information and communication campaigns.

1. Please see the Institute for Transportation and Development Policy's "Bus Rapid Transit Standard" for definitions: https://go.itdp.org/display/live/The+Bus+Rapid+Transit+Standard, accessed May 2014.

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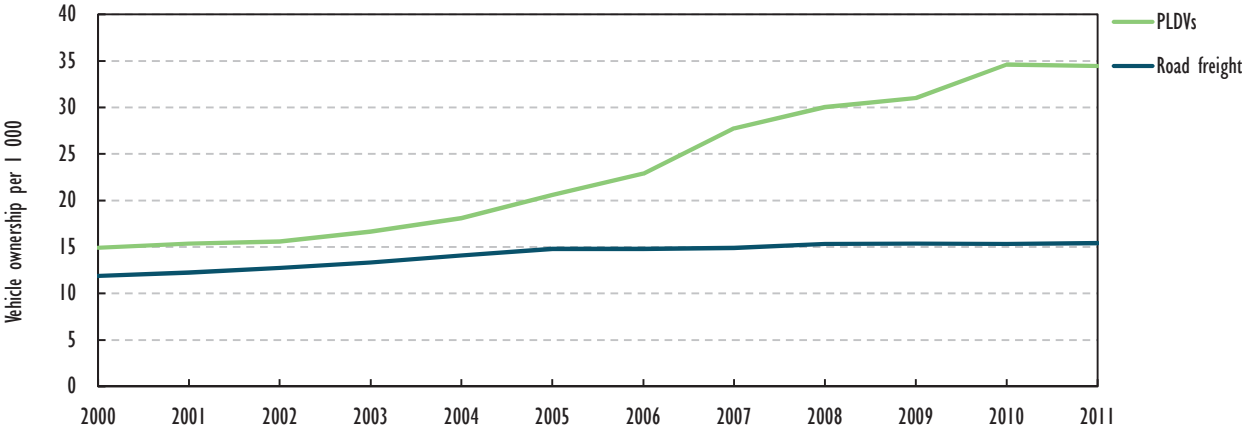
The capital stock of infrastructure (roads, ports, electricity and water) grew by 3% annually between 2001 and 2011, compared with an annual GDP growth of 5.3% (EIU, 2014). This slow relative growth, combined with rapid growth in motorisation, has resulted in congestion and high logistical costs, all of which undermine a functioning, equitable and sustainable transport system (Figure 10.5).

Figure 10.5 Motor vehicle ownership in Indonesia, 2000-11



Note: PLDV = passenger light-duty vehicle.

VEHICLES AND FUELS

The government has set targets to mitigate transport emissions, but its overall approach is to focus more on alternative fuels, such as natural gas and biofuels for transport, rather than apply demand-side management or improve system efficiency.

VEHICLES: POLLUTION AND EFFICIENCY

Euro 2 vehicle emission standards are in place, although enforcement and full implementation is lacking. Introduction of Euro 3 standards is underway, but there is a lack of coordination regarding both its introduction as well as enforcement. Discussions are under way between the Ministry of Environment and Pertamina to introduce Euro 4 standards, but there is concern at the cost and the implication that new refineries would need to be built. However, should Indonesia decide not to build new modern refineries, it may instead be faced with a lack of ready imports as others are reducing Euro 3 production.

A lack of effective co-ordination is apparent between the Ministry of Transport, the Ministry of Environment, and the Ministry of Energy and Mineral Resources (MEMR) to ensure that fuel efficiency standards, vehicle labelling and an eco-based taxation system are all effectively developed, implemented and enforced. For example, a project is planned to construct a refinery to produce fuel for Euro 4 gasoline vehicles in 2016, but there has been little if any consideration of whether or not vehicles are ready for it.

To achieve Indonesia's energy goals in a cost-effective and rapid manner, much could be done to apply Avoid and Shift options in relation to NMT, integrated land use planning and BRT. From the Improve perspective, it would be better to limit the singular focus on alternative fuels and instead improve motorcycles and passenger cars from a vehicle efficiency and fuel quality point of view, eventually promoting deployment of hybrid

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electric passenger cars (especially suitable for stop-start traffic in congested cities), and fully electric two-wheelers, both of which will improve efficiency, reduce fuel use and combat air pollution.

Two-wheelers: Too much of a good thing?

In 2011, motorcycles accounted for 82% of the vehicle fleet of 85 million, but despite this share, little consideration has been paid to increasing their efficiency or sustainability. This is particularly pertinent given that most are manufactured locally. The modal share of motorcycles continues to increase rapidly at the expense of public transport, with passenger cars accounting for 11% (9.5 million) (BPS, 2011).

In 2012, car sales increased by 24.8% from 2011 (Gaikindo, 2014), while motorcycle sales slowed in 2012 for the first time ever, dropping by 12% compared to 2011, with only 7.06 million sales (AISI, 2013).

Given the dominance of motorcycles on the road in Jakarta and other urban areas, greater attention should be paid to registering them, setting standards, enforcing those standards and supporting electric two-wheelers to reduce local air and noise pollution.

While electric two-wheelers would increase electricity demand, experiences from the Chinese market (around 200 million electric two-wheelers deployed) and analysis from *Energy Technology Perspectives 2014* (IEA, 2014), shows that due to the significant increase in efficiency (about six to nine times) of an electric two-wheeler compared to its internal combustion engine equivalent, the increased electricity demand and associated emissions would be more than offset through efficiency gains from a well-to-wheel perspective. Preliminary analysis by the IEA shows that around one to two power plants would be needed to power all 56 million two-wheelers of Indonesia, assuming they all converted to all-electric configurations.

Box 10.1 Fossil fuel subsidies

The price of diesel was doubled in 2005, and petrol and diesel were both raised by 30% in 2008. The government increased its subsidised petrol and diesel prices by 44% and 22%, respectively, in 2013. In November 2014, the government raised subsidised fuel prices again by almost one-third. Despite these increases, prices are still among the lowest in the world, especially for a net importing nation. Fossil fuel subsidies are growing as a percentage of the government budget, although recent price increases, the lowest in the world, especially for a net importing nation. Fossil fuel subsidies are growing as a percentage of the government budget, although recent price increases, the appreciation of the Indonesian rupiah, and lower oil prices will both soften the blow.

In 2012, spending on subsidies was equivalent to the central government's total capital and social spending combined. In other words, the country is beholden to both oil prices and its exchange rate with the US dollar.

Fuel subsidies are three times larger than infrastructure spending. This is a major imbalance, but also a major transfer opportunity. The government will struggle to keep increasing prices without providing alternatives to make transport more affordable, and that could be infrastructure for public transport. Because most users of fossil fuel subsidies are in urban centres, they would be best served by transferring the subsidies to public transport infrastructure.

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Box 10.1 Fossil fuel subsidies (*continued*)

As almost all diesel (98%) is used by the commercial sector, the price primarily affects trucks and buses. Bus fares are regulated by the government and not the bus operator. Thus, a hike in diesel prices does not automatically translate into a higher fare for the passenger. Subsidies for gasoline disproportionately benefit top income earners, while the bottom income earners often do not even use fuel since they cannot currently afford a vehicle.

A ban is in place on fuel subsidies for vehicles in mining, timber, and government and state-owned enterprises. While this has caused spending to decrease, fuel volumes have not, and with no enforcement in place it appears that fraud is prevalent.

As mentioned, Indonesia still has among the lowest fuel prices for net oil importing country worldwide (using latest available data from 2011). Gasoline in Indonesia is sold at IDR 6 500 per litre, but should be priced closer to ASEAN levels of IDR 12 147 (Philippines), IDR 12 453 (Thailand) and IDR 15 695 (Singapore) (GIZ, 2014). Ultimately, prices for petroleum products need to be brought to market value. The economic value of subsidies for oil-based fossil fuel consumption in 2012 in Indonesia was just over USD 20 billion, the fourth-highest worldwide after Saudi Arabia, Iran, and India (IEA, 2013). For 2014, it is projected that the total oil fuel and liquefied petroleum gas (LPG) subsidy will be IDR 210 trillion, with current annual growth equal to 24%.

A roadmap for subsidy removal was drafted five years ago, and was approved by the House of Representatives, but it has yet to be implemented. The Ministry of Finance is working hard to phase out subsidies, and MEMR is considering next steps forward. Similarly, efficiency is a highly cost-effective tool to rebalance Indonesia's current account deficit. Indonesia's push for CNG is undermined by artificially low fuel prices. While recent price hikes will help CNG compete, fighting one subsidy with another is not a sustainable pathway.

If the government removed fuel subsidies entirely, carbon dioxide (CO_2) emissions would fall by 6% by 2020, equivalent to achieving CO_2 reduction commitments not only for the transport sector, but also for the domestic, agriculture, energy and industrial sectors. The November 2014 fuel price increases are a positive step forward towards balancing Indonesia's economic, energy, and environmental goals, but unless the fuel prices are linked to a floating market index, the gains made will not prove lasting.

Low-cost green cars: At what cost?

The government has issued new tax cuts for "low-cost green cars" (car with engines below 1 000 cubic centimetres [cc]), which has led to increased car sales (Ministry of Industry, 2013). More than one million new vehicles were sold in 2012 for the first time.

The promotion of these vehicles may help achieve national manufacturing objectives, and the cars are, strictly speaking, more energy efficient by virtue of being smaller, but this is a perfect example of conflicting goals; although the policy may create new domestic jobs and improve fuel economy compared to larger cars, the end result for Indonesia could be worsened congestion, reduced modal share for public transport and rising air and noise pollution.

Promoting these cars enables them to access parts of Jakarta that may not have been accessible before, ultimately increasing congestion.

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FUELS: POLLUTION

Indonesia is making strides in improving fuel quality, with a roadmap to 2020 endorsed by the Ministry of Environment and MEMR to attain quality levels compatible with Euro 4 vehicle standards, including a new refinery to be constructed starting in 2016.

Efforts are also being made by the government to begin drafting standards for both vehicle fuel economy and fuel quality, to implement better parking management (stipulated in Law 22 of 2009), and to introduce eco-driving training for public taxi drivers.

Indonesia had a very high fuel sulphur content in 2010, at 2 000 parts per million (ppm), but is now on its way to achieving a 50 ppm average by 2020. This is commendable and will improve health and environment.

FUELS: ALTERNATIVES

Pertamina implemented an increase in the price of LPG in January 2014. This became a source of political conflict because of a lack of co-ordination between the Ministries of Transport and Environment and a lack of information being provided to the public. LPG is imported from abroad.

The government has shown strong interest in biofuels for transport, and is supporting them through the introduction of blending requirements, which are increasing from the current 7.5% to 10% (based on blending requirement starting 1 September 2013), with plans to increase them to 20% by the end of the decade. However, capacity has not been built up sufficiently from the supply side, and it is important that the right fuels are matched with the right vehicles, as not all vehicles can handle a high blending content.

In addition, subsidies may have to increase to maintain the biodiesel programme if the spread between diesel and crude palm oil (CPO) prices becomes negative. Finally, Pertamina, as the main supplier, currently has insufficient biodiesel blending capacity to support a 20% blend. Bioethanol is not being pursued for pricing reasons.

The government's aim of increasing biodiesel blending requirements for domestic fuels was to reduce reliance on imported, fossil fuel-based diesel. However, this measure is longer term in nature; the implementing regulation sets out annual increases in biodiesel in the fuel mix until 2025. As petroleum consumption is projected to grow by 1.7% per year between 2014 and 2020, blending may help ease demand (EIU, 2014), particularly considering that the country's oil import bill has risen to almost USD 40 billion per year, four times higher than in 2005.

There is some focus on battery electric vehicle (BEV) research, but nothing on hybrid electric vehicles (HEV), which could reap the efficiencies of stop-start traffic endemic to Indonesia's cities. For passenger cars, potential remains untapped for the adoption of stop-start technology, considerably useful in congested city conditions, with the potential to save between 3% and 10% fuel from stop-start technology alone, with much higher fuel savings resulting from full hybridisation (around 25%). In addition, electric two-wheelers would be very beneficial in limiting pollution and are relatively inexpensive.

Instead, the government is focusing on substituting oil with natural gas, as well as issuing a new tax cut for small, low-cost cars (less than 1 000 cc). Together, these may do little to alleviate congestion and pollution, and may in fact aggravate it.

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The role of natural gas in transport

Natural gas has the potential to be a transition fuel towards a more sustainable transport sector in Indonesia, and the country is currently trying to introduce CNG into the transport sector, preferring to source the gas locally. While natural gas is often well suited for power generation, for the transport sector it is not always ideal as it requires new infrastructure (including pipelines, refuelling stations and vehicle converter kits), the driving range is less and energy efficiency is lower than diesel (about equal to gasoline, and with no benefits when using converter kits).

On the upside, CNG can result in tank-to-wheel GHG benefits (up to 20%), not taking upstream emissions into account. Also, the greatest co-benefit is improved air quality through reduced local air pollutants.

In 2011, only 0.19% of natural gas used went to the transport sector. About 2 000 CNG vehicles operate in Indonesia today. Keeping everything else constant, were all Indonesia's natural gas supply to go to the transport sector, it could support about 1 million vehicles, which is equal to just one year of vehicle sales in Indonesia.

The government is aiming for gas to replace oil, and has to date focused on passenger cars, and to some degree buses and three-wheelers. Noting the pros and cons above, in the long term, the government would be wise to consider heavy goods vehicles and fleets as the best targets for the application of natural gas in transport.

The main challenge to natural gas growth is the absence of well-developed infrastructure to pipe supplies around the sprawling archipelago. Indonesia is an important exporter of natural gas, although it is building a liquefied natural gas (LNG) import terminal. Pertamina started a pilot project this year using LNG for transport applications, but no pricing policy exists yet for domestic LNG. Pertamina helps subsidise CNG stations alongside the government, but ultimately downstream gas prices mean transport is a loss-making venture, and transport growth demand is considered uninteresting and marginal compared to growth rates for industry (4%) and power (5%).

In Jakarta, CNG prices are fixed to create a market by Ministry of Energy Decree No. 2932 (K/12/MEM2011), setting the price at IDR 3 100 per litre (compared to IDR 8 500 per litre for gasoline and IDR 7 500 per litre for diesel). The government financed Pertamina's construction of refuelling stations, but only if it were able to do so within one year, which is partly why only ten were built, compared to 700 service stations in greater Jakarta. However, the government has a near monopoly on retail service stations, so in theory land acquisition should not be an impediment.

Little information is provided about converter kits, meaning few consumers know about them or how they work with the result that few are fitted. In addition, vehicle warranties become void after installation, which is a major disincentive for fitting converter kits. Uncertified converter kits are used for public transport vehicles in some cities, which raises safety issues since fitting needs to be done by qualified professionals. The Ministry of Industry has cut the budget for CNG conversion kits in 2013 to IDR 150 billion from IDR 200 billion. Overall, IDR 600 billion has been allocated for CNG and LNG infrastructure, including 10 000 free conversion kits, which are intended to be distributed by the Ministry of Transport.

Jakarta city council is in the process of purchasing CNG vehicles, with 450 TransJakarta CNG buses and 800 CNG minibuses delivered by the end of 2013 and a further 1 000 buses and 3 000 minibuses by the end of 2014. It is also planning to convert all

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official cars to CNG, as well as 3 000 *bajaj* (three-wheeled taxis) each year to CNG. This demonstrates little shortage of ambition or subsidy; what is largely missing is infrastructure. Only ten CNG stations are operational on Java, compared to Pertamina's original plans to have had 33 by the end of 2013. The state-owned gas firm Perusahaan Gas Negara has also launched mobile refuelling units.

Indonesia is seeking to use its natural gas resources since it is running out of oil, but given that Indonesia will only be able to meet 50% of its natural gas demand by 2025 according to MEMR, it is questionable whether or not Indonesia would be better served by implementing a longer-term policy so as to optimise the usage of natural gas, rather than solely maximise local resources.

In theory, natural gas would be well suited to dedicated fleets such as taxis and buses, but execution is important. Oil companies appear receptive to building natural gas infrastructure and subsidising converter kits, but as funds were not effectively dispersed and several safety incidents occurred, the programme has not been effective. From a systems perspective, natural gas might in Indonesia's case be better used in the power and industrial sectors; however, it could be beneficial from an urban perspective. Better programme co-ordination is needed together with a focus on bus and taxi fleets rather than hoping a passenger car market will spring up.

About 48.7% of gas is currently being used by industry. A total of 6 gigawatts of power could be generated using gas rather than fuel oil, due to the government's gas allocation system (see Chapter 3, "Natural Gas", for more information).

Finally, upstream methane emissions should be measured, which could then be used for a proper assessment of lifecycle GHG emissions from the use of natural gas in transport. This is currently not possible without such a framework.

ASSESSMENT

As part of Indonesia's commitment to mitigate GHG emissions, Transport Ministerial Regulation No. 201 (2013) aims to mitigate emissions in the sector through an Avoid, Shift and Improve approach, in line with recommendations of the last *Energy Policy Review of Indonesia* (IEA, 2008). In practice, this policy appears to be heavily biased towards the Improve option, as seen by an overwhelming focus on fuel substitution from oil to gas, rather than adopting all three in synergy to achieve maximum energy reduction.

Despite relatively lower prices for CNG compared to gasoline and diesel, this appears not to be cheap enough to attract consumers, not to mention other obstacles such as insufficient infrastructure, voiding of vehicle guarantees, and safety and performance issues (government fleets abstain from CNG vehicles for this reason).

Despite this technological bias, several Shift policies have been implemented, including car-free days on weekends, TOD planning and encouragement of the use of non-motorised vehicles. Air quality remains a major issue, especially as Euro 2 standards are still not fully implemented, not to mention full introduction of Euro 3, nor has lead been fully removed from fuel. Road pricing and parking management are still largely absent and yet, if implemented, would lower energy use and emissions, and reduce the cost of congestion. A commission was set up to investigate congestion charging, and a pilot project will be run in 2014.

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The lack of implementation is a cause of internal frustration within the government, with a sentiment that fewer recommendations are needed and instead more assistance on implementation. However, this is problematic when subsidies and policies undermine implementation. A policy shift from technologies and fuels towards a greater focus on systems efficiency would be the first, best step forward.

Natural gas in transport is emblematic of the government's challenges. MEMR has selected natural gas for promotion since Indonesia has the resource, but has then delegated implementation to the Ministry of Transport with little co-ordination and scant results. Indonesia is due to run out of local natural gas resources, so forcing the gas into transport will put pressure on a resource that could instead be used more effectively in the power and industry sectors.

The technologically biased focus on natural gas for transport usage should be seen in the context of the government wanting to replace oil in the transport sector, increasing the importance of LNG, and the disconnect between domestic and international gas prices. These together imply a considerable fiscal burden on the government.

In the freight sector, policy aims to shift road freight traffic to rail, but this has yet to materialise because of delays in implementing rail projects. Increasing freight transport integration between modes would elevate efficiency while reducing the already high cost of moving goods. A double-track project connecting Indonesia's two biggest cities, Jakarta and Surabaya, is under way, yet implementation must move faster as little has changed since the last *Energy Policy Review of Indonesia* (IEA, 2008).

Public awareness needs to be raised of the deleterious links between the current transport system, local air pollution and health impacts. This could be done, for example, with publically visible pollution indicators.

Indonesia should fund a comprehensive air quality monitoring system covering emissions and ambient air quality, and undertake comprehensive policing of rigorous and widespread vehicle testing to ensure the introduction and enforcement of Euro standards, in parallel with tighter fuel specifications.

MEMR and the Ministry of Transport continue to be ineffective at co-operating on the introduction and enforcement of vehicle standards, which accounts for the continuation of leaded gasoline, Euro 2 standards not fully being in place, and a lack of enforcement of unauthorised vehicles in the fleet.

Further work remains to be done on which vehicles should be allowed into the market, especially diesel vehicles that are very polluting in comparison to similar countries. This can only be achieved through better co-ordination. The Ministry of Transport says it follows national laws, but cannot enforce them if no viable alternatives exist. Low pollution fuels sometimes conflict with economic interests and suffer from low availability. When asked if leaded fuel were still available, the Ministry of Transport responded that they are only following what they are told to do by MEMR. The two ministries are advised, at the very least, to co-operate on the introduction and application of standards for new vehicles and the existing vehicle fleet.

RECOMMENDATIONS

The government of Indonesia should:

- ☐ *Prioritise energy efficiency, for example by increasing public awareness and state funding. Instruct government institutions and all state-owned enterprises to implement energy efficiency policies and regulations.*

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- *Improve vehicle efficiency and fuel quality as first steps towards reducing fossil fuel use and improving air quality through fuel economy standards and vehicle electrification, not only fuel substitution.*
- *Phase out fossil fuel subsidies and reinvest freed-up state funding for public transport infrastructure investment, which would increase overall transport system efficiency and improve access to safe and affordable mobility for all.*
- *Integrate land use and transport planning to enable land acquisition to support public transport, reduce congestion and create sustainable cities.*

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11. ENERGY TECHNOLOGY RESEARCH, DEVELOPMENT, DEMONSTRATION AND DEPLOYMENT

Key data (2013)

Government energy RD&D spending (nominal): USD 62 million, +75% since 2007

Government energy RD&D spending (adjusted): USD 54 million 2007 PPP, +59% since 2007

OVERVIEW

BACKGROUND

Indonesia is looking to energy diversification to minimise its dependence on imports. Vast solar and geothermal resources are currently underutilised, and research, development, demonstration and deployment (RDD&D) is seen as key to managing current issues and as a long-term tool for achieving a sustainable and secure energy future. This future can only take place if its human capital is well trained and supported adequately.

INSTITUTIONAL FRAMEWORK

Research and development (R&D) activities in the energy sector are co-ordinated by the Ministry of Mineral and Energy Resources (MEMR) and overseen by the Ministry of Research and Technology. Parallel to MEMR is the Agency for the Assessment and Application of Technology (BPPT), a non-governmental agency under the co-ordination of the Ministry of Research and Technology. MEMR's R&D is split into four research centres, focusing on oil and gas (LEMIGAS), electricity and new and renewable energy (P3TKEBTKE), minerals and coal (tekMIRA), and marine geology (P3GL). R&D increasingly includes regional and local governments in parallel, as well as the private sector.

Indonesia's R&D policy aims to provide evidence to guide future energy policy and to assist with implementation, particularly as it relates to achieving the National Energy Policy (NEP), which is reviewed several times during the year, and once a year by the Indonesian President, who chairs the National Energy Council (NEC). Energy R&D has well-defined goals across different time periods and sectors, with a focus on oil, gas and coal. The overall priority is to increase energy supply and security, with a focus on improving low-end quality coal for export, since domestic usage is focused on low-to-medium quality coal. Carbon capture and storage (CCS) is, along with coal-bed methane and shale gas exploration, part of this focus. MEMR is also seeking to promote coal and renewable energy, and to maximise capacity for public and private R&D.

Launched in 2012, the National Institute of Aeronautics and Space (LAPAN) conducts wind electricity research, a challenge given Indonesia's spread-out geography and the need for remote off-grid energy. LAPAN is also involved in climate research, focused on climate early warning systems, along with the Research Agency on Agro-climatology and Hydrology (BALITKILIMAT), Bogor Agriculture University (IPB) and the National Agency for Meteorology, Climatology and Geophysics (BMKG), as well as BPPT.

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Other pertinent R&D entities include the Ministries of Forestry and Agriculture, which are largely responsible for biofuel pilot projects, as well as the Regional Research Institute, which oversees local research activities.

Chapter VIII, Articles 29 and 30 of the 2007 Energy Law establish that the government of Indonesia is responsible for co-ordinating R&D on new and renewable energy technologies.

MINISTRY OF RESEACH AND TECHNOLOGY AND THE AGENCY FOR ASSESSMENT AND APPLICATION OF TECHNOLOGY (BPPT)

The Ministry of Research and Technology is responsible for formulating national policies in the field of research, science and technology, and co-ordinating its implementation across Indonesian stakeholders. Four non-departmental research agencies sit under the Ministry of Research and Technology involved in energy R&D:

- Agency for Assessment and Application of Technology (BPPT)
- Indonesian Institute of Sciences (LIPI)
- Nuclear Energy Regulatory Agency (BAPETEN)
- National Atomic Energy Agency (BATAN).

BPPT is the lead applied energy R&D institution in Indonesia and reports directly to the President of Indonesia. BPPT performs technological assessments and demonstrations, undertakes energy modelling and analysis to inform national policy makers, and works with the private sector and other government agencies to transfer technologies to the marketplace.

The BPPT technology focus conforms to the NEP, and includes research on a variety of biofuel feedstocks, coal gasification/liquefaction, small-scale geothermal plants (2.5 megawatts and lower), fuel cells, and, to a lesser extent, solar, ocean and wind energy. In addition to energy R&D and demonstration for the government, BPPT offers its services to the private sector on a fee-for-service basis.

BPPT's ongoing projects and areas of research include:

Transport sector:

- compressed natural gas (CNG) vehicles
- electric vehicles and battery development
- biofuels for transport.

Industrial sector:

- co-generation for textile industries
- coal gasification for fertiliser industries.

Household and commercial sectors:

- more efficient lighting
- air conditioners with inverters
- substitution of kerosene with liquid petroleum gas.

Electricity generation:

- solar photovoltaic (PV) programme for remote islands
- landfill gas power generation.

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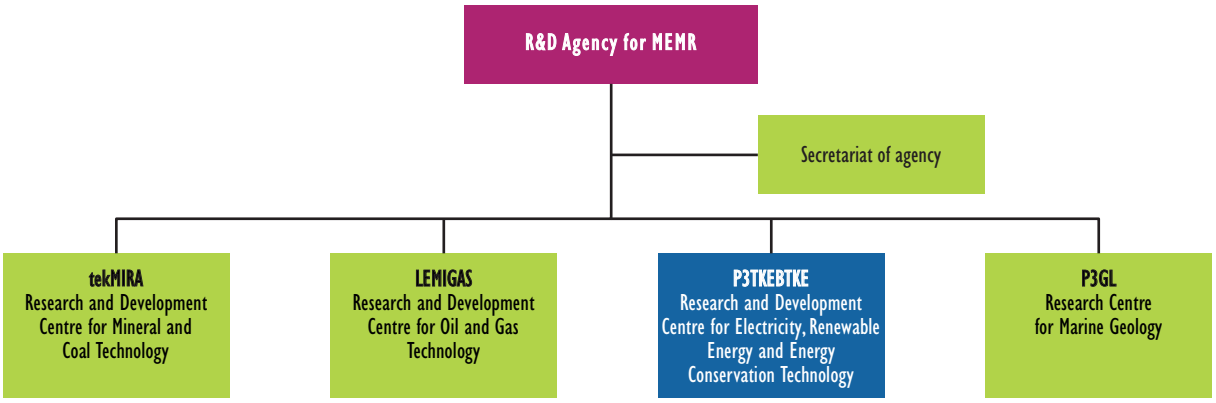
Projects are funded on a three- to five-year basis and are given goals such as providing information for national energy planning and policy; development of technology prototypes and demonstrations; and private sector uptake of technologies or processes. Projects are evaluated against these criteria upon completion by BPPT, whose role is to disseminate information on energy-saving technology.

AGENCY FOR RESEARCH AND DEVELOPMENT, MEMR

Within MEMR, the Agency for Research and Development co-ordinates four specialised R&D centres (Figure 11.1). The work of the Agency is reviewed by the Secretariat of the Agency for Research and Development.

- tekMira (R&D Centre for Mineral and Coal Technology)
- Lemigas (R&D Centre for Oil and Gas Technology)
- P3TKEBTKE (R&D Centre for Electricity, Renewable Energy and Energy Conservation Technology)
- P3GL (Research Centre for Marine Geology).

Figure 11.1 Organisation of the Agency for Research and Development, MEMR



Source: Research and Development Agency (2014), "Activities and Program of P3TKEBTKE", presentation for IEA in-depth review visit, March 2014, Ministry of Energy and Mineral Resources, Jakarta.

tekMira

As Indonesia is the largest thermal coal exporter in the world, tekMira's role is largely to assist the country in maintaining this pole position as well as enhancing coal production efficiency and quality. The goal is to use coal increasingly to substitute for depleting oil reserves. Since the last *Energy Policy Review of Indonesia* (IEA, 2008), the focus has been on increasing coal exports, but that has since shifted to increasing the value-added of coal, increasing energy security, developing underground coal gasification prospects, upgrading coal quality, developing syngas for industrial feedstock, improving coal burners for electricity and small industries, and pursuing coal gasification and liquefaction with low-grade coal. TekMira is leading the work on a coal research roadmap, which entails developing special coal research centres, with the aim of increasing coal gasification and liquefaction.

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P3GL

The Research Centre for Marine Geology conducts marine geological mapping, energy and mineral surveys, environmental and geological hazard surveys and generally contributes to the government's mineral and energy resource identification objectives.

LEMIGAS

LEMIGAS focuses on oil and gas technologies, including CCS (Box 11.1). Recently, LEMIGAS has worked closely with Pertamina, conducting two enhanced oil recovery (EOR) studies, aiming to increase oil and gas production. Other projects include a coal-bed methane pilot project, a CCS study with the World Bank and the Asian Development Bank, and a biodiesel pilot plant.

Box 11.1 CCS

CCS may offer an attractive greenhouse gas emissions reduction pathway for Indonesia. CCS research is co-ordinated by MEMR. Indonesia has no policies or laws encouraging development of CCS technologies or regulating the CCS project cycle. However, Indonesia has embarked on several policies on climate change, energy efficiency and energy conservation that could enable a high-level policy framework for CCS. Furthermore, Indonesia has fairly mature oil and gas and pipeline transportation industries that could readily adapt to CCS, given appropriate policy and incentives.

CO_2 (carbon dioxide)-based EOR may prove capable of boosting Indonesia's declining oil production significantly, with attendant economic benefits for developing near-term CCS demonstration. While Indonesia has begun a limited number of CCS studies, with international co-operation, a number of government officials were unaware of any evidence relating CCS to Indonesia's energy economy and environmental goals, hence, the importance of raising awareness of possible mitigation benefits.

As a next step, Indonesia could continue to expand its in-depth mapping of major carbon emissions sources and potential geologic storage formations and, further, estimate the CO_2 storage capacity (including depleted oil and gas and saline aquifers) and potential source-sink matching. This CO_2 storage information may be used to further reinforce public and stakeholder engagement, and importantly, capacity building among officials across central, provincial and local government.

An in-depth study in collaboration with the Asia Development Bank on CCS has been completed with a capture facility identified on Sumatra and a potential onshore storage location with potential for an EOR pilot project. The aim of the R&D is to advance towards a pilot demonstration, to expand technical and operational experience in aspects of the whole CCS chain with a focus on storage.

An important aspect of CCS is its applicability across major industrial CO_2 emissions sources, including from biofuels and bioenergy conversion. This is an additional area that Indonesia has begun to study further. By combining bioenergy with CCS (BECCS), there is the potential for negative emissions if the feedstock is grown sustainably. In conjunction with managed forest and reforestation, Indonesia also may assess opportunities for mitigation through this terrestrial CO_2 storage in agriculture, forest management and sustainable land use.

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P3TKEBTKE

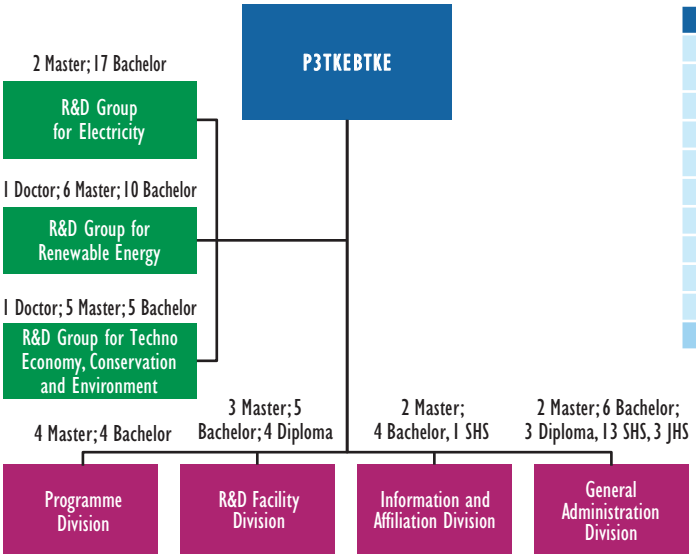
The Centre for Electricity and New and Renewable Energy changed its name in 2010 from P3TKEBT to P3TKEBTKE to incorporate energy conservation, becoming the Centre for Electricity, Renewable Energy and Energy Conservation Technology, thereby signalling a new emphasis on energy efficiency and conservation. This, along with associated projects, staff and funding, represents a further step in the right direction. As energy efficiency remains largely unexploited in Indonesia, it would greatly benefit from focusing less exclusively on R&D related to increasing the energy supply, and more on how to reduce consumption through energy efficiency, which is the "hidden" but ultimately the cheapest "fuel" in the country.

TRAINING AND HUMAN CAPACITY

Across MEMR, the Education and Training Agency (ETA) is responsible for training and human capacity development. Training and education centres differentiated by discipline are integral to this endeavour, such as the ETA oil and gas centre. However, several capacity gaps have been identified, particularly for renewable energy, including solar PV and geothermal energy. Further, it appears that the ETA's knowledge management policy is not always well-matched to its R&D targets, as government research centres and training centres lack human resources, for example with regard to the geothermal sector and subsea well technology.

Nevertheless, P3TKEBTKE has more than doubled funding and staff since the last *Energy Policy Review of Indonesia* (IEA, 2008), with several projects from wind to geothermal, and several publications to its name. Figure 11.2 below outlines where its human capacity is being concentrated by educational level.

Figure 11.2 Organisation and human capacity of P3TKEBTKE, 2013



No	Classifications	Total
1	Researcher	36
2	Engineer	12
3	Technician	2
4	Analyst	1
5	Planner	2
6	Legal drafter	1
7	IT	2
8	Archivist	1
9	Librarian	1
10	Others	42
TOTAL		100

Notes: *Bachelor* = bachelor's degree; *Master* = master's degree; *Doctor* = doctorate; *Diploma* = Indonesian university-level degree; *SHS* = senior high school; *JHS* = junior high school.

Source: Research and Development Agency (2014), "Activities and Program of P3TKEBTKE", presentation for IEA in-depth review visit, March 2014, Ministry of Energy and Mineral Resources, Jakarta.

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ENERGY R&D STRATEGY AND PROGRAMME EVALUATION

The R&D focus is on problem solving, implementation and providing input to the government's formulation of future energy policy, which is evaluated on the following metrics:

- to develop applied technology
- to explore potential energy and mineral resources
- to conduct techno-economic, environmental and energy conservation assessments
- to disseminate and promote R&D results, and to build networks
- to develop knowledge management and support innovation
- to strengthen the institutional framework to support technological development
- to utilise technological services based on R&D.

The overarching goal is to pursue sustainable energy supplies, as outlined in the NEP. R&D is intended to support this, with a primary focus on maintaining oil and gas production, a secondary focus on promoting coal and renewable energy, and a final goal of maximising national capacity for public and private R&D, which involves working closely with BPPT.

Processes to collect statistics and indicators are in place to seek to measure progress; however, much of the forecasting and modelling work appears to take place after a policy has been implemented rather than beforehand, when it could help assess a policy's potential impact.

CO-ORDINATING AND LINKING ENERGY R&D TO THE NEP

There is evidence of a lack of proper monitoring and evaluation of R&D spending against NEP priorities, as noted in the last *Energy Policy Review of Indonesia* (IEA, 2008); low-priority projects (e.g. CNG for transport) received funding that could cost-effectively be spent on, for instance, energy efficiency R&D (IDR 388 million spent in 2013).

The National Research Council meets several times a year across ministries to co-ordinate funding, set priorities and develop roadmaps to help R&D contribute to achieving the NEP (Figure 11.3). Various stakeholders are consulted on R&D policy. However, stakeholders feel they are often consulted after a policy has already been set, and there appears to be significant overlap and little cross-ministerial communication to avoid duplication of effort. Responsibilities are not always clear, and once a goal has been stipulated, there is often a long time lag while it is decided which agency should be put in charge of implementation.

Public dissemination takes place through an information facility, including a substantial library, public website and production of the *Journals of Indonesia Mining*, *Bulletin of Marine Geology* and *Oil and Gas Scientific Journal.* However, *Electricity and Renewable Energy Journal* is still published in Bahasa Indonesia. Translation of this information into English is lacking, which hampers international collaboration, technology transfer of Indonesian know-how and sharing of best practices.

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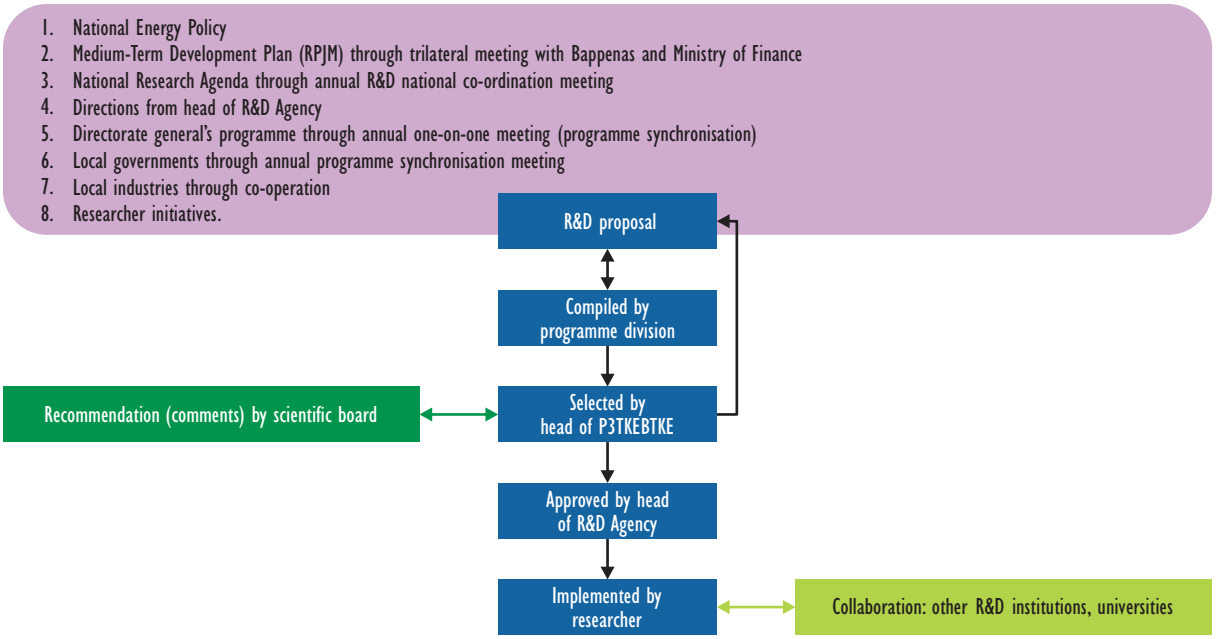
Figure 11.3 Decision-making process for establishing priorities



Source: Research and Development Agency (2014), "Activities and Program of P3TKEBTKE", presentation for IEA in-depth review visit, March 2014, Ministry of Energy and Mineral Resources, Jakarta.

R&D FUNDING

Since the last *Energy Policy Review of Indonesia* (IEA, 2008), the country has made impressive investments in energy R&D, almost doubling funding (from IDR 400 billion in 2007 to IDR 700 billion in 2013) (Table 11.1) as well as doubling the number of researchers (note that these amounts do not fully capture energy R&D spending by LIPI, BPPT and universities).

Table 11.1 Funding for MEMR R&D centres, 2007 and 2013 (IDR billion)

Centre	National government funding		Private sector funding*	
	2007	2013	2007	2013
tekMira	110	130	2.6	4.3
Lemigas	362	353	26.3	65.0
P3TKEBTKE	44	93	0	0
Research Centre for Marine Geology	95	114	0	0
Agency of Geology	433	0	0.1	0
Total	**1 044**	**690**	**29.0**	**69.3**

* Non-tax state revenue (PNBP).

Source: Ministry of Energy and Mineral Resources, Jakarta.

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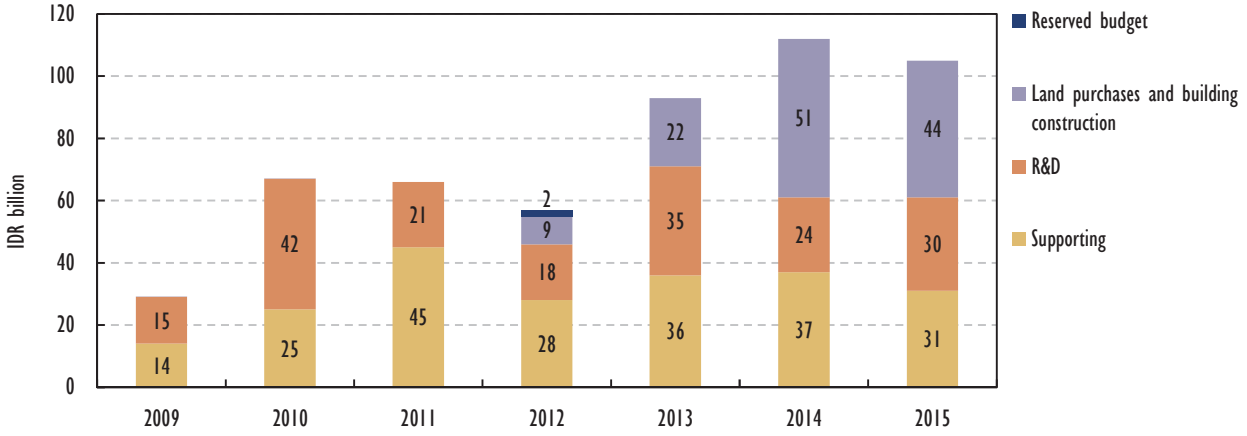
To ensure commercial relevance among RDD&D technologies, some level of industry cost sharing should be required. Following successful demonstration, deployment incentives could include government loan guarantees and tax credits, which are two examples of cost sharing between government, industry and academia that Indonesia may want to consider.

Figure 11.4 P3TKEBTKE budget (2009-15)



Source: Research and Development Agency (2014), "Activities and Program of P3TKEBTKE", presentation for IEA in-depth review visit, March 2014, Ministry of Energy and Mineral Resources, Jakarta.

INTERNATIONAL COLLABORATION

Indonesia took a leading role in the United Nations Framework Convention on Climate Change (UNFCCC) process via its emission reduction commitment at G20 Summit in Pittsburgh in 2009. It has also shown leadership in the Association of Southeast Asian Nations (ASEAN) group, hosting its Secretariat. The country is a member of several international fora on energy, including:

- member of the International Renewable Energy Agency (IRENA)
- member of the Clean Energy Ministerial (CEM)
- observer of the Global Bioenergy Partnership
- member of the International Organization for Standardization (ISO)
- signatory to the UNFCCC.

This high-level collaboration is important. On a technical level, Indonesia takes part in a number of bilateral initiatives with countries within the Asia-Pacific region, as well as Europe (Table 11.2). More could be done, however, to build the capacity of Indonesian energy researchers through active participation in international expert networks, such as the IEA Implementing Agreements, for example in the areas of energy efficiency (buildings, electricity, industry or transport), oil and gas, CCS and renewables.

Overall, Indonesia's current international engagement does not match its population size and resource base. International collaboration should be an essential component for assisting Indonesia to achieve the NEP, avoiding duplication and drawing on international expertise where national competition is not threatened.

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Table 11.2 Examples of Indonesia's participation in international energy R&D co-operation

Country	Institution	Activities	Indonesia R&D organisation
Japan	New Energy and Industrial Technology Development Organization (NEDO)	PV grid stability	P3TKEBTKE
UK	Dept of Energy and Climate Change, UK	2050 energy calculator	Lemigas
France	*Laboratoire des Sciences du Climat et de l'Environnement* (LSCE), Perancis	Cruise MD181-MONOCIR 2 Research Vessel Marion Dufresne; Monsoon And Ocean Circulation Di Selat Makassar, Laut Maluku Dan Laut Halmahera (2010)	Research Centre for Marine Geology (P3GL)
Germany	The Faculty of Natural Science and Mathematics of the University of Kiel of the Federal Republic of Germany	The MAJA cruise SO-217 in the Indonesian Archipelago (2011) Objectives: Carry out a regional multicore core-top calibration within the Makassar Strait and Java Sea, and undertake high resolution measurements of the following paleoceanographic proxies in piston cores over the last two glacial cycles.	Research Centre for Marine Geology (P3GL)
Korea	The Korean Institute of Energy Research (KIER)	Study on Indonesian Low Rank Coal Upgrading Preparation Using Coal Upgrading Palm Oil (CUPO) Technology	R&D Centre for Coal And Mineral Technology (tekMIRA)
Korea	Korean Institute of Geoscience and Mineral Resources (KIGAM)	Memorandum of Understanding (MoU) between ARDEMR and KIGAM concerning scientific and technical co-operation in coal and mineral development Activities planned: 1. composite of nano silica 2. reduce coal ash content.	R&D Centre for Coal And Mineral Technology (tekMIRA)

Source: Ministry of Energy and Mineral Resources, Jakarta.

PRIVATE SECTOR ACTIVITIES

The Indonesian government's priority is innovation, centred on new pilot projects to demonstrate feasibility to the private sector. MEMR is co-operating with industry in an effort to understand its needs, and is looking to strengthen its working relationships. Nonetheless, ongoing difficulties include the emergence of few proven quality products, a lack of reward for inventors due to an absence of regulation for managing the shift from R&D to production, intellectual property concerns, and few synergies with academia, business or other government agencies.

For Indonesia's energy R&D initiatives to reach their full potential, a better investment framework is necessary to speed up deployment by supporting market incentives, with a streamlined regulatory framework (permitting, licensing and adequate market frameworks) to support innovation.

Co-operation with the private sector is currently carried out through one of two means:

- under the co-ordination of the Ministry of Research and Technology for incentive or partnership programmes
- direct co-operation between the government and private institutions, through an MoU.

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An example of private sector co-operation with the government includes coal gasification to provide syngas as a fuel and raw material for manufacturing processes in the paper, tea, chemical and fertiliser industries.

ASSESSMENT

Total energy RD&D funding levels appear to have grown by 75% in the period between 2007 and 2013, which is highly commendable, although within MEMR it appears that funding has not grown as needed, especially within Lemigas. Commendable efforts have been made since the last *Energy Policy Review of Indonesia* (IEA, 2008): the restructuring of P3TKEBTKE; conforming the BPPT technology focus to align with the NEP and evaluating projects against NEP criteria upon completion; forming the National Research Council; and doubling funding of energy RDD&D.

However, efforts made to co-ordinate R&D across ministries to achieve the NEP have been insufficient according to several stakeholders. A national energy R&D co-ordination strategy could be developed to help identify clear roles and responsibilities for different ministries. It should also include regularly scheduled meetings of experts to co-ordinate research projects, as well as help to improve transparency for industry and the public. The annual meeting is sufficiently frequent, but budget discussions appear to take place a year before, with little co-ordination between ministries and even less co-ordination with industry – harmonisation is necessary for synchronised discussions and effective results.

The NRC should recommend priority projects that could be co-led by two or more ministries to ensure implementation as innovation requires the support of a number of ministries. Internal co-ordination is essential for RDD&D; otherwise, spending on labs will not translate into demonstration and deployment.

Since energy efficiency can help meet several of Indonesia's goals, the government would benefit from a greater focus on demand-side energy R&D to complement their current focus on the supply side. However, at present there is an overwhelming supply-side focus, with an emphasis on a set of selected technologies such as natural gas. What is needed is greater consistency between its energy R&D programme and its energy strategy, and more technology-neutrality in its deployment support so that the most cost-effective technologies are pulled into the market.

Human capacity needs to be better linked, not only between national and regional organisations, but generally matched towards the need at hand. Knowledge could be better disseminated with a greater effort towards outreach with other regional groups, and it would be greatly aided by more translated documents and online data accessibility.

Despite being a member of several international energy organisations, Indonesia's response to the last review's recommendation to increase its international engagement has not been fulfilled, especially considering the country's population size and resource base. Enhancing international collaboration would provide access to technically unbiased review and assessment.

RECOMMENDATIONS

The government of Indonesia should:

- ☐ *Continue increasing R&D investment as needed to achieve the NEP, rebalance from supply to demand-focused energy R&D, and recognise that fossil fuel subsidies undermine Indonesia's energy goals from research through to deployment.*

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- *Strengthen human capacity and knowledge management to ensure Indonesia has the experience, human resources and infrastructure necessary to achieve the NEP. Research facilities and staff need to be better matched to help meet energy strategy goals, such as providing properly trained personnel for geothermal operations.*
- *Work more closely with industry and the private sector, academia and international research networks to demonstrate new energy technologies and support deployment through market incentives and regulation. Creating public-private partnerships would be one such facility to ensure implementation.*
- *Develop a structured road-mapping process that engages stakeholders across a range of institutions and industry on technology or sector-specific roadmaps (e.g. renewable energy, bioenergy, CCS, transport).*

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PART II
ANNEXES

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ANNEX A: ORGANISATION OF THE REVIEW

REVIEW CRITERIA

The Shared Goals, which were adopted by the IEA Ministers at their 4 June 1993 meeting in Paris, provide the evaluation criteria for the in-depth reviews (IDRs) conducted by the IEA. The Shared Goals are presented in Annex C.

REVIEW TEAM

The IDR team visited Jakarta from 10 to 18 March 2014. During the week-long visit, the review team met with government officials, representatives from ministries and government agencies, energy producers and suppliers, bilateral donor agencies, multilateral investment banks, think tanks, interest groups and various other organisations and stakeholders. This report was drafted on the basis of these meetings, the government of Indonesia response to the IEA energy policy questionnaire and other information. The team is grateful for the co-operation and hospitality of the many people it met during the visit. Thanks to their openness and candour, the review visit was highly productive.

In particular, the team wishes to express its gratitude to Mr. Susilo Siswoutomo, the Vice Minister for Energy and Mineral Resources of Indonesia, for his support to the review process and to his staff for providing detailed briefings on energy policy in Indonesia. Their willingness to share information and gracious hospitality contributed in no small way to a successful and productive visit. The author is particularly thankful to Mr. Agung Wahyu Kencono, Head, PUSDATIN, Ministry of Energy and Mineral Resources, Mr. Sugeng Mujiyanto, Acting Head, Strategic Data Analysis and Evaluation Division, PUSDATIN, Ministry of Energy and Mineral Resources, Mr. Aang Darmawan, Energy Assessment Sub-Division, PUSDATIN, Ministry of Energy and Mineral Resources, and Mr. Catur Kurniadi, PUSDATIN, Ministry of Energy and Mineral Resources, for co-ordinating the team visit and their ongoing support throughout the drafting process.

The members of the review team were:

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Ms. Jodi Smith, Manager, Electricity Market Development, Department of Industry, Australia

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Mr. Paul Chambers, Senior Adviser Energy and Climate Change, Embassy of the United Kingdom to Indonesia

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Mr. Florian Kitt, Global Energy Policy Division, IEA

Florian Kitt managed the review and is the author of the report. The chapters were drafted by the members of the review team: Chapters 1 and 2 by Florian Kitt, Chapter 3 by Kieran McNamara and Sun Joo Ahn, Chapter 4 by Aad van Bohemen and Sun Joo Ahn, Chapter 5 by Thomas Sarkus and Florian Kitt, Chapter 6 by Paul Chambers and Florian Kitt, Chapter 7 by Yerim Park and Jodi Smith, Chapter 8 by Andreas Kleine and Florian Kitt, Chapter 9 by Paul Westin and Yerim Park, and Chapters 10 and 11 by Tali Trigg. Eleonora Antar also made a substantial contribution to the drafting and preparation of the final report. Carlos Fernández Alvarez, Pierre Boileau, Anselm Eisentraut, Farid Hussin, Christina Hood, Marc Lafrance, Yuichiro Nishida, Carrie Pottinger, Cecilia Tam, and Michael Waldron contributed helpful comments throughout.

Sonja Lekovic prepared the figures and Bertrand Sadin the graphs and maps. Markus Fager-Pintila and Emmanouil Christinakis provided support on statistics. Muriel Custodio, Therese Walsh, Astrid Dumond, Jane Barbière and Angela Gosmann managed the production process. Justin French-Brooks provided editorial assistance.

ORGANISATIONS VISITED

Adaro

Agence Française Developpement

Association Geothermal Indonesia

Berau

Berau Coal

BP

Bukit Asam

Center for Data and Information, Ministry of Energy and Mineral Resources

Chevron

ConocoPhillips

Co-ordinating Ministry for Economic Affairs

Delma Mining

Department of Foreign Affairs and Trade, Australia

Department of Transport, City of Jakarta

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Directorate-General for Electricity, Ministry of Energy and Mineral Resources

Directorate-General for Minerals and Coal, Ministry of Energy and Mineral Resources

Directorate-General for New Renewable Energy and Energy Conservation, Ministry of Energy and Mineral Resources

Directorate-General for Oil and Gas, Ministry of Energy and Mineral Resources

Ernst & Young

ESCO Association

ExxonMobil

GDF Suez

General Office for Statistics

German International Cooperation (GIZ)

ICA Indonesia

Indonesia Coal Mining Association

Indonesia ESCO Association

Indonesia Infrastructure Guarantee Fund

Indonesia Renewable Energy Society (METI)

Institute of Energy Economics

IPP Association

Japan International Cooperation Agency

Kaltim Prima Coal

McDermott

Ministry for Planning (BAPPENAS)

Ministry of Environment

Ministry of Finance

Ministry of Industry

Ministry of Research and Technology

Ministry of Trade

Ministry of Transport

National Council on Climate Change

National Energy Council

Office of the Vice Minister, Ministry of Energy and Mineral Resources

PERTAMINA

PLN

PT Dow Indonesia

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Qenergy Southeast Asia

Research and Development Agency, Ministry of Energy and Mineral Resources

SKK MIGAS

Synergy Carbon Indonesia

The World Bank Group

University of Jakarta

United States Agency for International Development

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ANNEX B:
ENERGY BALANCES AND KEY STATISTICAL DATA

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Unit: Mtoe

SUPPLY		1971	1980	1990	2000	2010	2011	2012
TOTAL PRODUCTION		**71.72**	**125.04**	**168.50**	**237.43**	**379.83**	**422.56**	**440.25**
Coal		0.12	0.17	5.85	45.45	186.33	233.27	255.73
Peat		-	-	-	-	-	-	-
Oil		44.95	79.50	74.59	71.60	48.44	46.15	44.49
Natural gas		0.24	14.96	42.10	61.11	74.74	71.03	67.27
Biofuels and waste[1]		26.34	30.28	43.54	50.04	52.73	54.93	55.47
Nuclear		-	-	-	-	-	-	-
Hydro		0.07	0.12	0.49	0.86	1.50	1.07	1.10
Wind		-	-	-	-	0.00	0.00	0.00
Geothermal		-	-	1.93	8.37	16.09	16.11	16.19
Solar/other		-	-	-	-	0.00	0.00	0.00
TOTAL NET IMPORTS[2]		**-34.14**	**-68.63**	**-69.88**	**-81.80**	**-170.36**	**-217.42**	**-227.20**
Coal	Exports	-	0.07	2.72	33.54	155.88	207.81	225.99
	Imports	0.02	0.03	0.43	0.09	0.04	0.03	0.05
	Net imports	0.02	-0.04	-2.30	-33.45	-155.85	-207.78	-225.94
Oil	Exports	36.61	68.87	49.81	38.80	23.02	20.10	19.34
	Imports	2.73	10.82	9.43	25.59	45.91	47.90	52.44
	Int'l marine and aviation bunkers	-0.28	-0.49	-0.86	-0.52	-0.86	-0.91	-0.97
	Net imports	-34.15	-58.54	-41.24	-13.73	22.03	26.89	32.13
Natural Gas	Exports	-	10.01	26.29	34.57	35.95	35.40	32.29
	Imports	-	-	-	-	-	-	-
	Net imports	-	-10.01	-26.29	-34.57	-35.95	-35.40	-32.29
Electricity	Exports	-	-	-	-	-	-	-
	Imports	-	-	-	-	-	-	0.26
	Net imports	-	-	-	-	-	-	0.26
TOTAL STOCK CHANGES		**-2.53**	**-0.71**	**-0.00**	**0.00**	**-0.05**	**0.19**	**0.54**
TOTAL SUPPLY (TPES)[3]		**35.05**	**55.70**	**98.61**	**155.63**	**209.43**	**205.33**	**213.59**
Coal		0.13	0.16	3.55	12.01	30.48	25.49	29.79
Peat		-	-	-	-	-	-	-
Oil		8.27	20.23	33.35	57.87	70.39	73.22	77.18
Natural gas		0.24	4.95	15.80	26.54	38.79	35.63	34.98
Biofuels and waste[1]		26.33	30.25	43.49	49.98	52.17	53.81	54.09
Nuclear		-	-	-	-	-	-	-
Hydro		0.07	0.12	0.49	0.86	1.50	1.07	1.10
Wind		-	-	-	-	0.00	0.00	0.00
Geothermal		-	-	1.93	8.37	16.09	16.11	16.19
Solar/other		-	-	-	-	0.00	0.00	0.00
Electricity trade[4]		-	-	-	-	-	-	0.26
Shares in TPES (%)								
Coal		*0.4*	*0.3*	*3.6*	*7.7*	*14.6*	*12.4*	*13.9*
Peat		-	-	-	-	-	-	-
Oil		*23.6*	*36.3*	*33.8*	*37.2*	*33.6*	*35.7*	*36.1*
Natural gas		*0.7*	*8.9*	*16.0*	*17.1*	*18.5*	*17.4*	*16.4*
Biofuels and waste[1]		*75.1*	*54.3*	*44.1*	*32.1*	*24.9*	*26.2*	*25.3*
Nuclear		-	-	-	-	-	-	-
Hydro		*0.2*	*0.2*	*0.5*	*0.6*	*0.7*	*0.5*	*0.5*
Wind		-	-	-	-	-	-	-
Geothermal		-	-	*2.0*	*5.4*	*7.7*	*7.8*	*7.6*
Solar/other		-	-	-	-	*0.00*	*0.00*	*0.00*
Electricity trade[4]		-	-	-	-	-	-	*0.1*

0 is negligible, - is nil, .. is not available, x is not applicable. Please note: rounding may cause totals to differ from the sum of the elements.

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Unit: Mtoe

DEMAND							
FINAL CONSUMPTION	**1971**	**1980**	**1990**	**2000**	**2010**	**2011**	**2012**
TFC	**32.06**	**49.64**	**79.81**	**121.26**	**149.69**	**151.86**	**159.66**
Coal	0.09	0.09	2.13	4.65	8.28	5.18	4.68
Peat	-	-	-	-	-	-	-
Oil	6.38	17.29	27.24	49.01	61.44	63.30	69.31
Natural gas	0.10	2.36	6.02	11.55	15.85	16.65	17.33
Biofuels and waste[1]	25.34	29.33	41.98	49.24	51.40	52.99	53.26
Geothermal	-	-	-	-	-	-	-
Solar/other	-	-	-	-	-	-	-
Electricity	0.15	0.56	2.43	6.81	12.73	13.75	15.08
Heat	-	-	-	-	-	-	-
Shares in TFC (%)							
Coal	*0.3*	*0.2*	*2.7*	*3.8*	*5.5*	*3.4*	*2.9*
Peat	-	-	-	-	-	-	-
Oil	*19.9*	*34.8*	*34.1*	*40.4*	*41.0*	*41.7*	*43.4*
Natural gas	*0.3*	*4.8*	*7.5*	*9.5*	*10.6*	*11.0*	*10.9*
Biofuels and waste[1]	*79.0*	*59.1*	*52.6*	*40.6*	*34.3*	*34.9*	*33.4*
Geothermal	-	-	-	-	-	-	-
Solar/other	-	-	-	-	-	-	-
Electricity	*0.5*	*1.1*	*3.0*	*5.6*	*8.5*	*9.1*	*9.4*
Heat	-	-	-	-	-	-	-
TOTAL INDUSTRY[5]	**1.72**	**7.96**	**25.44**	**40.44**	**49.73**	**47.49**	**48.66**
Coal	0.06	0.08	2.13	4.65	8.28	5.18	4.68
Peat	-	-	-	-	-	-	-
Oil	1.55	5.37	8.82	12.76	15.03	14.73	15.54
Natural gas	0.10	2.36	6.00	11.49	15.69	16.43	17.04
Biofuels and waste[1]	-	-	7.24	8.62	6.33	6.39	6.18
Geothermal	-	-	-	-	-	-	-
Solar/other	-	-	-	-	-	-	-
Electricity	0.02	0.15	1.25	2.93	4.40	4.76	5.22
Heat	-	-	-	-	-	-	-
Shares in total industry (%)							
Coal	*3.6*	*1.0*	*8.4*	*11.5*	*16.6*	*10.9*	*9.6*
Peat	-	-	-	-	-	-	-
Oil	*89.7*	*67.5*	*34.7*	*31.6*	*30.2*	*31.0*	*31.9*
Natural gas	*5.8*	*29.7*	*23.6*	*28.4*	*31.5*	*34.6*	*35.0*
Biofuels and waste[1]	-	-	*28.5*	*21.3*	*12.7*	*13.5*	*12.7*
Geothermal	-	-	-	-	-	-	-
Solar/other	-	-	-	-	-	-	-
Electricity	*0.9*	*1.9*	*4.9*	*7.2*	*8.9*	*10.0*	*10.7*
Heat	-	-	-	-	-	-	-
TRANSPORT[3]	**2.69**	**5.95**	**10.71**	**21.87**	**35.98**	**39.19**	**44.10**
OTHER[6]	**27.65**	**35.73**	**43.65**	**58.94**	**63.98**	**65.18**	**66.91**
Coal	-	-	-	0.01	-	-	-
Peat	-	-	-	-	-	-	-
Oil	2.17	5.98	7.72	14.39	10.62	9.69	10.25
Natural gas	-	-	0.02	0.04	0.15	0.19	0.24
Biofuels and waste[1]	25.34	29.33	34.74	40.62	44.90	46.32	46.55
Geothermal	-	-	-	-	-	-	-
Solar/other	-	-	-	-	-	-	-
Electricity	0.13	0.41	1.18	3.88	8.32	8.99	9.86
Heat	-	-	-	-	-	-	-
Shares in other (%)							
Coal	-	-	-	-	-	-	-
Peat	-	-	-	-	-	-	-
Oil	*7.9*	*16.7*	*17.7*	*24.4*	*16.6*	*14.9*	*15.3*
Natural gas	-	-	-	*0.1*	*0.2*	*0.3*	*0.4*
Biofuels and waste[1]	*91.7*	*82.1*	*79.6*	*68.9*	*70.2*	*71.1*	*69.6*
Geothermal	-	-	-	-	-	-	-
Solar/other	-	-	-	-	-	-	-
Electricity	*0.5*	*1.2*	*2.7*	*6.6*	*13.0*	*13.8*	*14.7*
Heat	-	-	-	-	-	-	-

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Unit: Mtoe

DEMAND							
ENERGY TRANSFORMATION AND LOSSES	**1971**	**1980**	**1990**	**2000**	**2010**	**2011**	**2012**
ELECTRICITY GENERATION[7]							
Input (Mtoe)	1.20	2.26	8.93	28.04	53.59	57.75	63.76
Output (Mtoe)	0.15	0.65	2.81	8.03	14.60	15.77	16.85
Output (TWh)	1.76	7.50	32.67	93.33	169.79	183.42	195.90
Output Shares (%)							
Coal	-	-	*29.9*	*36.4*	*40.3*	*44.2*	*48.7*
Peat	-	-	-	-	-	-	-
Oil	*56.0*	*82.1*	*46.9*	*19.7*	*20.1*	*23.1*	*16.7*
Natural gas	-	-	*2.2*	*28.0*	*23.7*	*20.8*	*23.2*
Biofuels and waste[1]	-	-	-	-	*0.1*	*0.1*	*0.1*
Nuclear	-	-	-	-	-	-	-
Hydro	*44.0*	*17.9*	*17.5*	*10.7*	*10.3*	*6.8*	*6.5*
Wind	-	-	-	-	-	-	-
Geothermal	-	-	*3.4*	*5.2*	*5.5*	*5.1*	*4.8*
Solar/other	-	-	-	-	-	-	-
TOTAL LOSSES	**2.89**	**4.47**	**19.44**	**35.39**	**57.69**	**60.28**	**61.66**
of which:							
Electricity and heat generation[8]	1.05	1.62	6.12	20.02	38.98	41.97	46.91
Other transformation	1.21	0.72	2.40	1.38	1.19	3.10	2.40
Own use and transmission/distribution losses[9]	0.63	2.14	10.92	14.00	17.51	15.21	12.36
Statistical Differences	**0.10**	**1.60**	**-0.64**	**-1.02**	**2.04**	**-6.80**	**-7.74**
INDICATORS	**1971**	**1980**	**1990**	**2000**	**2010**	**2011**	**2012**
GDP (billion 2005 USD)	40.58	80.88	150.09	226.92	377.90	402.43	427.48
Population (millions)	117.00	145.49	178.63	208.94	240.68	243.80	246.86
TPES/GDP (toe/1000 USD)[10]	0.86	0.69	0.66	0.69	0.55	0.51	0.50
Energy production/TPES	2.05	2.24	1.71	1.53	1.81	2.06	2.06
Per capita TPES (toe/capita)	0.30	0.38	0.55	0.74	0.87	0.84	0.87
Oil supply/GDP (toe/1000 USD)[10]	0.20	0.25	0.22	0.26	0.19	0.18	0.18
TFC/GDP (toe/1000 USD)[10]	0.79	0.61	0.53	0.53	0.40	0.38	0.37
Per capita TFC (toe/capita)	0.27	0.34	0.45	0.58	0.62	0.62	0.65
Energy-related CO_2 emissions ($MtCO_2$)[11]	25.1	68.9	146.1	272.8	392.4	400.3	435.5
CO_2 emissions from bunkers ($MtCO_2$)[11]	0.9	1.5	2.6	1.6	2.6	2.7	2.9
GROWTH RATES (% per year)	**71-80**	**80-90**	**90-00**	**00-09**	**09-10**	**10-11**	**11-12**
TPES	5.3	5.9	4.7	2.8	4.7	-2.0	4.0
Coal	0.9	36.5	13.0	10.9	-0.1	-16.4	16.9
Peat	-	-	-	-	-	-	-
Oil	4.8	5.1	5.7	1.4	7.6	4.0	5.4
Natural gas	17.2	12.3	5.3	2.9	12.9	-8.2	-1.8
Biofuels and waste[1]	0.7	3.7	1.4	0.6	-1.1	3.1	0.5
Nuclear	-	-	-	-	-	-	-
Hydro	3.0	15.5	5.8	1.4	53.3	-28.9	3.1
Wind	-	-	-	-	-	33.3	-
Geothermal	-	-	15.8	7.4	0.7	0.1	0.5
Solar/other	-	-	-	-	-	-	200.0
TFC	5.0	4.9	4.3	2.1	2.6	1.4	5.1
Electricity consumption	16.2	15.8	10.8	6.2	8.8	8.0	9.7
Energy production	6.4	3.0	3.5	4.5	7.9	11.2	4.2
Net oil imports	..	..	..	..	31.8	22.0	19.5
GDP	8.0	6.4	4.2	5.1	6.2	6.5	6.2
TPES/GDP	-2.5	-0.5	0.4	-2.2	-1.4	-7.9	-2.1
TFC/GDP	-2.8	-1.4	0.1	-2.9	-3.4	-4.7	-1.0

0 is negligible, - is nil, .. is not available, x is not applicable. Please note: rounding may cause totals to differ from the sum of the elements.

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Footnotes to energy balances and key statistical data

1. Biofuels and waste comprises solid biofuels, liquid biofuels and municipal waste. Data are often based on partial surveys and may not be comparable between countries.
2. In addition to coal, oil, natural gas and electricity, total net imports also include biofuels.
3. Excludes international marine bunkers and international aviation bunkers.
4. Total supply of electricity represents net trade. A negative number in the share of TPES indicates that exports are greater than imports.
5. Industry includes non-energy use.
6. "Other" includes residential, commercial and public services, agriculture/forestry, fishing and other non-specified.
7. Inputs to electricity generation include inputs to electricity plants. Output refers only to electricity generation.
8. Losses arising in the production of electricity and heat at main activity producer utilities and autoproducers. For non-fossil fuel electricity generation, theoretical losses are shown based on plant efficiencies of approximately 10% for geothermal and 100% for hydro, wind and solar photovoltaic.
9. Data on "losses" for forecast years often include large statistical differences covering differences between expected supply and demand and mostly do not reflect real expectations on transformation gains and losses.
10. Toe per thousand USD at 2005 prices and exchange rates.
11. "Energy-related CO_2 emissions" have been estimated using the IPCC Tier I Sectoral Approach from the *Revised 1996 IPCC Guidelines*. In accordance with the IPCC methodology, emissions from international marine and aviation bunkers are not included in national totals. Projected emissions for oil and gas are derived by calculating the ratio of emissions to energy use for 2012 and applying this factor to forecast energy supply. Future coal emissions are based on product-specific supply projections and are calculated using the IPCC/OECD emission factors and methodology.

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ANNEX C: GLOSSARY AND LIST OF ABBREVIATIONS

In this report, abbreviations and acronyms are substituted for a number of terms used within the International Energy Agency. While these terms generally have been written out on first mention, this glossary provides a quick and central reference for the abbreviations used.

AFD	French Agency for Development
AMDAL	Environment Impact Assessment
APSA	ASEAN Petroleum Security Agreement
ASEAN	Association of SouthEast Asian Nations
AAU	assigned amount unit
BALITKILIMAT	Research Agency on Agro-climatology and Hydrology
BAPETEN	Nuclear Energy Regulatory Agency
BAPPENAS	Ministry of National Development Planning
BATAN	National Atomic Energy Agency
BAU	business as usual
bbl	barrels
bcf/d	billion cubic feet of gas per day
bcm	billion cubic metres
BECCS	bioenergy with carbon capture storage
BEV	battery electric vehicle
BGR	Federal Institute for Geosciences and Natural Resources
BHP MIGAS	Body for Oil & Gas Downstream Activity
BKPM	Investment Co-ordinating Board
BMKG	National Agency for Meteorology, Climatology and Geophysics
BPK	National Audit Bureau
BPP	Black Power Plant
BPPT	Agency for the Assessment and Application of Technology
BPS	Statistics Indonesia - Badan Pusat Statistik
BRT	bus rapid transit
BSN	National Standardisation Agency
BVGL	“business viability guarantee” letter
CCGT	combined-cycle gas turbine
CCoW	coal contract of work
cc	cubic centimetres
CCS	carbon capture and storage
CEM	Clean Energy Ministerial
CNG	compressed natural gas
CNY	Yuan renminbi
CO_2	carbon dioxide

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CPO	crude palm oil
CTF	Clean Technology Fund
CUPO	Indonesian Low Rank Coal Upgrading Preparation Using Coal Upgrading Palm Oil
DEN	National Energy Council
DGE	Directorate General of Electricity
DGNREEC	Directorate General of New, Renewable Energy and Energy Conservation
DGOG	Directorate General of Oil and Gas
DGs	Directorate Generals
DIY	Daerah Istimewa Yogyakarta (Indonesia)
DMO	domestic market obligation
DPD	Regional Representatives' Assembly
DPR	House of Representatives
E&P	exploration and production
EBR	energy buffer reserves
EL7	Energy Law No. 30 2007
EOR	enhanced oil recovery
ESDM	Ministry of Energy and Mineral Resources (Kementerian Energi dan Sumber Daya Mineral)
ESSV	energy self-sufficient village
EST	environmentally sustainable transportation
ETA	Education and Training Agency
FBI	Indonesian Biodiesel Forum
FiT	feed-in tariff
FLNG	floating liquefied natural gas
FSRU	floating storage and regasification unit
FTP	First Tranche Petroleum
GR	Government Regulation
GDP	gross domestic product
GHG	greenhouse gas
GoI	government of Indonesia
GTA	gas transportation agreements
GW	gigawatt
GW_e	gigawatt electrical capacity
HEV	hybrid electric vehicles
HVDC	high-voltage direct current transmission system
IBF	Indonesian Biodiesel Forum
ICCTF	Indonesia Climate Change Trust Fund
ICP	Indonesian Crude Price
IDR	Indonesian rupiah

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IGF	Infrastructure Guarantee Fund
IIGF	Indonesia Infrastructure Guarantee Fund
IMF	International Monetary Fund
IMO	International Maritime Organisation
IPB	Bogor Agriculture University
IPP	independent power producer
IRENA	International Renewable Energy Agency
ISPO	Indonesian Sustainable Palm Oil System
ISO	International Organization for Standardization
ITPS	Institution for Transport Policy Studies
ITS	intelligent transport systems
IUP	mining business licence (Izin Usaha Pertambangan)
IUPKs	special mining business licences
IUPTL	licence to provide electricity for public use
JCM	joined carbon mechanism
JTM	medium-voltage network
JTR	low-voltage network
kb/d	thousand barrels per day
kcal/kg	kilocalorie per kilogramme
KEN	National Energy Plan
KIER	Korean Institute of Energy Research
KIGAM	Korean Institute of Geoscience and Mineral Resources
kL	kilolitre
km	kilometre
kmc	kilometre of circuit
KPK	Anti-Corruption Commission
kWh	kilowatt hour
kv	kilovolt
LAPAN	National Institute of Aeronautics and Space
LEMIGAS	Centre for Oil and Gas Technology
LGV	LPG for vehicles
LIPI	Indonesian Institute of Sciences
LMCM	Law on Mineral and Coal Mining
LNG	liquefied natural gas
LPG	liquefied petroleum gas
LSCE	Laboratoire des Sciences du Climat et de l'Environnement
Markal	Market Allocation Model
mb/d	million barrels per day
MBtu	million British thermal units
MDG	Millennium Development Goals
MEMR	Ministry of Energy and Mineral Resources (Kementerian Energi dan Sumber Daya Mineral [ESDM])
MEPS	minimum energy performance standards
MoE	Ministry of Environment

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MoF	Ministry of Finance
MoI	Ministry of Industry
MOPS	Mean of Platts Singapore
MoT	Ministry of Transport
MoTr	Ministry of Trade
MoU	Memorandum of Understanding
MP3EI	Master Plan for the Acceleration and Expansion of Indonesia's Economic Development
MPR	Peoples Consultative Assembly
MPW	Ministry of Public Works
MRT	plans for metro
MRV	monitoring, reporting and verification
MMstb	million stock tank barrels
m/s	metres per second
MSW	municipal solid waste
$MtCO_2$-eq	million tonnes of CO_2-equivalent
Mtoe	million tonnes of oil-equivalent
MW	megawatt
MW_e	megawatt electrical capacity
MWh	megawatt hour
MWp	megawatt peak
NAMAs	Nationally Appropriate Mitigation Actions
NAMA SUTRI	Nationally Appropriate Mitigation Actions - Sustainable Urban Transport Program
NAPRGG	National Action Plan to Reduce Greenhouse Gas Emissions
NAD	Nanggroe Aceh Darussalam
NCCC	National Council on Climate Change
NCS	Nusantara Carbon Scheme
NEC	National Energy Council
NEDO	New Energy and Industrial Technology Development Organization
NEP	National Energy Plan
NEP14	NEP revised in February 2014
NESO	National Emergency Strategy Organisation
NGO	non-governmental organisation
NMT	non-motorised travel
NO_x	nitrogen oxide
NTT	Nusa Tenggara Timur (Indonesia province)
NTB	Nusa Tenggara Barat (Indonesia province)
OECD	Organisation for Economic Co-operation and Development
OPEC	Organization of the Petroleum Exporting Countries
Pertagas	PT Pertamina Gas
P3GL	Research Centre for Marine Geology
P3TKEBTKE	Centre for Electricity, Renewable Energy and Energy Conservation Technology

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PGN	PT Perusahaan Gas Negara
PLN	PT Perusahaan Listrik Negara
PPA	power purchase agreement
PPM	parts per million
PPP	purchasing power parity
PPP	public-private partnership
PPU	private power utilities
PSC	production sharing contract
PSO	public service obligation
PUSDATIN	Center of Data and Information of MEMR (Pusat Data dan Sistem Informasi Pertanian)
PV	photovoltaic
RAN-GRK	Indonesian government's national greenhouse gas action plan
REDD	reducing emissions from deforestation and forest degradation
RD&D	research and development
RDD&D	research development, demonstration and deployment
RFCC	residual fluid catalytic cracking
RFID	radio frequency identification
RIKEN	Master Plan for National Energy Conservation
RPJM	
RUEN	National Energy General Plan
RUKN	National Electricity Master Plan (Rencana Umum Ketenagalistrikan Nasional)
RUPTL	Electricity Power Supply Business Plan (Rencana Usaha Penyediaan Tenaga Listrik)
SEC	specific energy consumption
SKK MIGAS	Special Task Force for Upstream Oil and Gas Business Activities
SNI	Indonesian National Standard
SSWJ	Southern Sumatra and Western Java
SO_x	sulphur oxides
TAC	technical assistant contract
tcf	trillion cubic feet
tcm	trillion cubic metres
tekMira	Centre for Mineral and Coal Technology
TFC	total final consumption
TGI	Transportasi Gas Indonesia
TOD	transit-oriented development
toe	tonne of oil equivalent, defined as 10^7 kcal
TPES	total primary energy supply
TSO	transmission system operator
tscf	trillion standard cubic feet
TWh	terawatt hour

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UNFCCC	United Nations Framework Convention on Climate Change
UNIDO	United Nations Industrial Development Organization
USD	United States dollar
VA	volt ampere
VAT	value-added tax
vkm	vehicle kilometre miles
WPN	State Reserve Zones

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Energy Policies
Beyond IEA Countries

Indonesia 2015

Indonesia can claim many economic and political achievements over the last 15 years: the country posted consistently high economic growth rates, joined the G20, stabilised its young democracy, and devolved budgetary power and decision making. Extending this track record further depends on Indonesia's ability to deliver sustainable and sufficient energy supply to markets and ultimately to consumers.

Even though it remains a net energy exporter due to the expansion of its coal and liquid biofuel production, the country is consuming more energy as a result of rising living standards, population growth and rapid urbanisation. Indonesia is already highly dependent on oil imports. Meeting demand growth and ensuring the environmental sustainability of energy supplies must remain key pillars of its economic and investment policies and strategies.

Indonesia has implemented important changes since the IEA published its first review of the country's energy policies in 2008. Key milestones include the 2007 Law on Energy, the 2009 Law on Electricity, the 2009 Law on Mineral and Coal Mining, and the 2014 National Energy Policy. However, the government needs to continue this reform process vigorously and implement further improvements to Indonesia's institutional set-up, alongside stronger policy planning and implementation, more investment in critical energy infrastructure, and continued movement towards regulated energy markets and cost-reflective pricing.

This review analyses the energy policy challenges facing Indonesia and provides critiques and recommendations for further policy improvements. It is intended to help guide the country towards a more secure and sustainable energy future.

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