INTERNATIONAL ENERGY AGENCY

Energy Policy Review of INDONESIA

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The Republic of Indonesia is the world's fourth most populous nation and a developing economy in transition. It is now consolidating its democratic government and implementing governance and financial reforms. After the Asian financial crisis of 1997-99, Indonesia's economy has returned to a strong and stable 5-6% annual growth.

Over recent decades, its resource wealth, openness to trade and investment, and a strategically favourable location in East Asia have made Indonesia a key global exporter of oil, gas, and coal. However, Indonesia now faces the serious challenge of fast-rising domestic energy demand with declining oil and gas production. The country's energy policy makers are looking closely at domestic energy requirements and best policies to meet these needs. This includes moving prices towards international parity, improving the energy sector investment climate, and developing electricity generation capacity. While some very difficult decisions have been made over recent years, many challenges remain.

Energy Policy Review of Indonesia **assesses the country's major energy issues. The study was conducted by a team of IEA member country specialists – an approach which has also been used for national and sectoral reviews of other non-IEA countries, including Angola, China, India, Russia, and Ukraine, as well as the Western Balkan region. The Review offers an analysis of Indonesia's energy sector, with findings and recommendations that draw on experience in IEA member countries. Six areas are suggested for priority attention, including progressive reduction in fuel and electricity subsidies, better implementation of policy, improving clarity of the investment framework, helping the energy regulators do their job more effectively, and harnessing a sustainable development agenda particularly renewable energy and energy efficiency.**

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100€ (61 2008 25 1 P1) ISBN 978-92-64-04828-7

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The International Energy Agency (IEA) is an autonomous body which was established in November 1974 within the framework of the Organisation for Economic Co-operation and Development (OECD) to implement an international energy programme.

It carries out a comprehensive programme of energy co-operation among twenty-eight of the OECD thirty member countries. The basic aims of the IEA are:

- To maintain and improve systems for coping with oil supply disruptions.
- To promote rational energy policies in a global context through co-operative relations with non-member countries, industry and international organisations.
- To operate a permanent information system on the international oil market.
- To improve the world's energy supply and demand structure by developing alternative energy sources and increasing the efficiency of energy use.
- To promote international collaboration on energy technology.
- To assist in the integration of environmental and energy policies.

The IEA member countries are: Australia, Austria, Belgium, Canada, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Japan, Republic of Korea, Luxembourg, Netherlands, New Zealand, Norway, Poland, Portugal, Slovak Republic, Spain, Sweden, Switzerland, Turkey, United Kingdom and United States. The European Commission also participates in the work of the IEA.

ORGANISATION FOR ECONOMIC CO-OPERATION AND DEVELOPMENT

The OECD is a unique forum where the governments of thirty democracies work together to address the economic, social and environmental challenges of globalisation. The OECD is also at the forefront of efforts to understand and to help governments respond to new developments and concerns, such as corporate governance, the information economy and the challenges of an ageing population. The Organisation provides a setting where governments can compare policy experiences, seek answers to common problems, identify good practice and work to co-ordinate domestic and international policies.

The OECD member countries are: Australia, Austria, Belgium, Canada, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Japan, Republic of Korea, Luxembourg, Mexico, Netherlands, New Zealand, Norway, Poland, Portugal, Slovak Republic, Spain, Sweden, Switzerland, Turkey, United Kingdom and United States.
The European Commission takes part in the work of the OECD.

International Energy Agency (IEA),
Head of Communication and Information Office,
9 rue de la Fédération, 75739 Paris Cedex 15, France.

FOREWORD

Indonesia is a major player in the world energy economy. It is the world's leading steam coal exporter, a substantial LNG exporter, and, until recently, an oil exporter. Indonesia is also the fourth most populous nation and a developing economy with annual growth on a stable path of 5-6%. It is undergoing a demanding evolution from a central planned system to a democratic community with advancing market principles. Such transitions take time, and I commend the government and the people of Indonesia on the breadth of change: there is now a palpable sense of openness, confidence and interest that was not there just several years ago.

I am delighted and honoured that the International Energy Agency was invited by H.E. Dr Purnomo Yusgiantoro, Minister of Energy & Mineral Resources of Indonesia, to undertake this energy policy review of Indonesia. Sound energy policies and their effective implementation are the basis for economic development. The International Energy Agency (IEA) conducts in-depth energy policy reviews of each of our 28 member countries every five years. This is done to strengthen national policy and to share best practice policy and programme experiences. In recent years, the IEA has been asked to undertake reviews of national and sectoral energy policy of non-IEA countries, including Angola, China, India, Russia, and Ukraine, as well as the Western Balkan region.

For the Energy Policy Review of Indonesia, the IEA worked in collaboration with the Ministry of Energy and Mineral Resources. This Review comprehensively examines all parts of the energy sector in Indonesia, and provides findings and policy recommendations for each. Past energy policy decisions and slow action to correct them have led to the serious longer-term energy challenges confronting Indonesia today. In the Executive Summary, six areas are suggested for priority attention. These cover the progressive reduction in fuel and electricity subsidies, better implementation of policy, improving clarity of the investment framework, helping the energy regulators do their job more effectively, and harnessing a sustainable development agenda, particularly renewable energy and energy efficiency.

I must add that when the Review Team held its discussions with the government of Indonesia and stakeholders, it became clear that the Team's findings would not be new. Most government policy makers and industry specialists have been thinking similarly but have not had sufficient support to make changes. I hope that this Review provides both a strong "third voice" to support their future work, and, importantly, contributes to international understanding of Indonesian energy policy and the potential for future trade and investment.

Finally, the IEA is an energy policy think tank with more than 30 years of experience. Through our outreach programmes to key non-IEA countries, such as Indonesia, we hope to engage in dialogue and sharing of international best practice in energy policy.

I am very pleased that the IEA and the Ministry of Energy and Mineral Resources have already mapped out a programme of work for the coming two years and I hope this is the presage of a close and outcome-orientated working relationship.

Nobuo Tanaka
Executive Director

ORGANISATION OF THE REVIEW AND ACKNOWLEDGEMENTS

The IEA Energy Policy Review of Indonesia is based on the findings and recommendations of the Review Team of energy officials and specialists during their Review mission to Jakarta in summer 2007. The Review Team members were drawn from IEA Member Country governments and associated organisations.

The Policy Review also reflects comments that the Secretariat subsequently received from the Government of Indonesia (GOI) in late 2007 and April 2008, and subsequent review of the draft by IEA and external experts.

Ministry of Energy and Mineral Resources of Indonesia

The IEA Indonesia Energy Policy Review 2007 was undertaken in partnership and co-operation with the Indonesian Ministry of Energy and Mineral Resources (MEMR). The IEA gratefully acknowledges the close co-operation of the Directorate Generals of MEMR and the Ministry's Agencies of Geology, of Research and Development, and of Education and Training.

In particular, the IEA appreciates the close working partnership that has developed with the Ministry's Centre for Energy and Mineral Resources Data and Information (PUSDATIN). The organisational expertise and effort of PUSDATIN made possible the undertaking of the Review Mission in July 2007, subsequent IEA information gathering missions to Jakarta in late 2007 and early 2008, and the MEMR's official review of the draft report in April 2008.

Energy sector data used in the Review

It is usual practice for IEA Energy Policy Reviews to use energy data compiled and published by the IEA for the country being reviewed. This ensures international consistency of energy definitions, units, and formats. However, Indonesia is not an IEA member country and the data set held by the IEA for Indonesia's energy sector is limited. Consequently, to ensure consistency of data as much as possible, the decision was taken to use data provided by the MEMR Centre for Energy and Mineral Resources Data and Information (PUSDATIN) for this Review.

PUSDATIN was established in 2001 to centralise and develop consistency and completeness across Indonesia's energy data series. This requires collecting data from MEMR Directorate Generals, energy regulatory agencies, state-owned energy companies and utilities, private energy companies, and other agencies, and converting and compiling the data according to harmonised energy definitions, units, time periods, and formats. All efforts have been made by PUSDATIN to ensure data consistency, and, while there are some remaining issues, PUSDATIN continues to work to resolve them.

Organisations engaged in the course of the Review

In the course of developing an understanding of the issues and challenges facing Indonesia and its energy sector, the Review Team consulted extensively with the following organisations located in and around Jakarta. The Review Team greatly appreciated the warmth and hospitality of the meetings and the extensive and open discussions and comments from the following organisations:

- Minister of the Ministry of Energy and Mineral Resources (MEMR)
- Secretary General (Legal, Finance, Planning and Co-ordination), MEMR
- Directorate General of Electricity and Energy Utilisation, MEMR
- Directorate General of Oil and Gas, MEMR
- Bidding Area Office, Directorate General of Oil and Gas, MEMR
- Directorate General of Mineral, Coal and Geothermal, MEMR
- Centre for Energy and Mineral Resources Data and Information, MEMR
- Centre for Energy Policy, MEMR
- Agency for Geology, MEMR
- Agency for Research and Development, MEMR
- Agency for Training and Education, MEMR
- National Development Planning Agency (BAPPENAS)
- Co-ordinating Ministry for the Economy
- Ministry of Forestry
- Ministry of Finance
- Ministry of Trade
- Ministry of Transportation
- State Ministry for the Environment
- State Ministry for Research and Technology
- Executive Agency for Upstream Oil and Gas (BP MIGAS)
- Oil and Gas Downstream Regulatory Body (BPH MIGAS)
- PT Pertamina (National oil and gas company)
- PT Perusahaan Gas Negara (PT PGN) (National gas distribution and retail company)
- Chevron Indonesia
- Medco Energy
- Indonesia Petroleum Association
- Indonesia Gas Association
- Hiswana Migas (Oil and gas retail association)
- National Atomic Energy Agency (BATAN)
- Nuclear Energy Regulatory Agency (BAPETEN)
- PT Perusahaan Listrik Negara (PT PLN) (National electricity company)
- PT Indonesia Power (subsidiary of PT PLN)
- Committee for the Acceleration of Electricity Development
- Paiton Energy Company
- Indonesia Electrical Power Society (MKI)
- PT Batubara Bukit Asam (National coal company)
- PT Kaltim Prima Coal
- Indonesia Coal Mining Association
- National Team for Biofuel Development
- Indonesia Biodiesel Forum

- PT Energy Management Indonesia
- Indonesia Renewable Energy Society (METI)
- Association Geothermal Indonesia
- Indonesia Institute of Energy Economics
- ASEAN Centre for Energy.

IEA Member Countries contributions

The IEA Secretariat is highly appreciative of the support of its Member Countries for the Review. It has been exceptionally well supported by Member Countries, both in terms of funding through Voluntary Contributions (Japan, Netherlands, New Zealand, South Korea, United Kingdom, and USA) and the provision of highly skilled experts to be part of the Review Team (Australia, Canada, Finland, Japan, Netherlands, New Zealand, Norway, South Korea, United Kingdom, and USA).

The IEA also gratefully acknowledges the very many reviewers from within the IEA Secretariat and from IEA Member Countries whose expertise and comments provided support and finessing of the Review Team's findings and recommendations, in particular Robert Alderson, Alex Arter, Virginie Bahnik, Sankar Bhattacharya, Pieter Boot, Christine Caralis, Pierpaolo Cazzola, Doug Cooke, Keith Croker, Tom Cutler, Jean-Christophe Fueg, Ian Cronshaw, Lew Fulton, Rebecca Gaghen, Jean-Yves Garnier, Hiroshi Hashimoto, Neil Hirst, Catherine Hunter, Andrea Nour, Isabel Murray, Yo Osumi, Roberta Quadrelli, William Ramsay, Brian Ricketts, Nasha Abu Samah and Paul Waide.

The IEA Review Team

Finally, and most importantly, the IEA Secretariat very gratefully acknowledges the interest, expertise and authorship of the Review Team members and their willingness to volunteer their extended time for this Review. The Review Team members were:

Team Leader
Mr Leonard Coburn
President
Coburn International
Washington
USA

Government Policy, Structure and Process
Professor Nigel Lucas
Professor Emeritus
Imperial College
London
United Kingdom

Trade and Investment
Mr Takashi Omote
Director for Planning and Research, International Affairs Division
Agency for Natural Resources and Energy
Ministry of Economy, Trade and Industry
Tokyo
Japan

Energy and Environment
Professor Nigel Lucas (also Government Policy, Structure and Process)

Energy Efficiency and Conservation
Mr Robert Tromop
Manager, Monitoring and Technical
Energy Efficiency and Conservation Authority
Wellington
New Zealand

Renewable energy
Mr Nico van der Linden
Senior Energy Economist
Energy Research Centre of the Netherlands
Petten
The Netherlands

Oil and Gas Upstream
Mr Espen Myhra
Assistant Director General for Gas and Infrastructure
Ministry of Petroleum and Energy
Oslo
Norway

Oil Downstream
Mr Leonard Coburn (also Team Leader)

Gas Downstream
Dr Jung Gi Chul
Korea Gas Corporation
Seoul
Republic of Korea

Coal
Mr Kevin Stone
Mineral Policy Advisor, Minerals and Metals Sector
Natural Resources Canada
Ottawa
Canada

Grid Electricity
Mr Tim Mason
Manager
Governance, National Energy Market Branch
Department of Resources and Tourism
Canberra
Australia

Rural Electricity
Ms Jolanka Fischer
Country Studies Division
IEA Secretariat
Paris
France

Nuclear
Dr Timo Haapalehto
Counsellor
Permanent Representation of Finland to the EU
Brussels
Belgium

Energy Research and Development, and Training
Mr Thomas Kerr
Energy Technology Policy Division
IEA Secretariat
Paris
France

Team Management
Brett Jacobs and Yo Osumi
Office of Global Energy Dialogue
IEA Secretariat

Brett Jacobs managed the Review and drafted the report with the Review Team members. The IEA Communication and Information Office provided key support: Rebecca Gaghen, Muriel Custodio, Sophie Schlondorff and Jane Barbière provided guidance and supervised the production, and Bertrand Sadin prepared all maps and figures.

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The boundaries and names shown and the designations used on maps included in this publication do not imply official endorsement or acceptance by the IEA.

I. EXECUTIVE SUMMARY

This Review seeks to examine all components of the energy sector in the Republic of Indonesia, and provide findings and recommendations for each. This Executive Summary suggests six areas for priority attention. These cover:

- domestic energy pricing and subsidies;
- policy co-ordination, decision making and implementation;
- energy sector investment;
- independence and authority of energy regulators;
- harnessing of a sustainable development agenda particularly through renewable energy implementation; and
- mainstreaming of energy efficiency and conservation policy.

The setting

Indonesia is the world's fourth most populous nation, with 240 million people spread over a large archipelago of more than 6 000 inhabited islands. The population within Indonesia is concentrated, with about 80% living on Java-Madura-Bali.

Indonesia is engaged in a radical transition from an autocratic, centrally planned economy to a democratic community with a much greater reliance on liberalised market principles. This transition is bold and necessary; it must succeed as it will improve the climate for investment in Indonesia. In many ways, the benefits of the reforms introduced to date are already visible: Indonesia is clearly a more open, confident society than it was before the reforms. After the significant dip as a result of the Asian financial crisis of 1997-99, economic growth has returned to a stable path of 5-6% annually.

However, the challenges for the Government of Indonesia (GOI) are still huge: the unemployment rate is persistently high; there is severe poverty in rural areas and on the urban margins; and access to the basic services of electricity, water, sewage, transport, trade, education, and health is still limited. The challenges in the energy sector are many and are discussed throughout the Review. Possibly the most important are Indonesia's declining oil and gas production and the fast increasing domestic requirements for oil and gas; the persistent electricity and petroleum subsidies and price controls; and the limited clarity in Indonesia's energy sector governance, co-ordination and decision making regime.

Domestic energy pricing and subsidies

Indonesia's energy price caps and subsidies keep prices for individual consumers below market levels for electricity and selected petroleum products, namely kerosene, automotive diesel oil for transport, and 88 RON gasoline. While these subsidies are no longer available for larger industrial consumers, they are equally accessible to Indonesia's poor and wealthy. In May 2008, the Co-ordinating Ministry of Economic Affairs of Indonesia advised that the top 40% of high income families benefit from 70% of the subsidies, while the bottom 40% of low income families benefit from only 15% of the subsidies. In essence, the subsidies are missing their target and benefiting the rich more than the poor.

Indonesia's long entrenched petroleum and electricity subsidies and price caps have made the country highly vulnerable to global energy price movements. This was particularly so during the rapid rise in international oil prices in 2007-08. While the country is meeting its short-term energy needs, the situation masks the critical problems of the subsidies and price caps and their knock-on impact on investment, efficiency, and diversification. They have inhibited investment in upstream and downstream energy sectors by new investors as well as existing public and private players, have undermined energy efficiency and renewable energy programmes for many years, and have reduced the ability of enterprises to accommodate the cost of environmental compliance.

As felt by the current and previous governments in Indonesia, these subsidies also incur major financial and political management costs for the state and for the state-owned companies responsible for their implementation. Most immediately, GOI expenditure on subsidies continues to reduce its ability to provide government services.

The vast majority of Indonesians have come to rely on low energy prices as part of their limited household budgeting and, as a consequence, the GOI has been reluctant to take necessary decisive action until a crisis loomed. The relatively widespread acceptance of subsidy reductions in October 2005 and May 2008 highlighted the growing awareness of Indonesian communities of the need for some level of reform.

The Review Team recommends the removal of the subsidies and price caps. Allowing cost-reflective pricing should be the critical priority. As recognised by the GOI, removal of price subsidies does not need to be undertaken in one painful step. A phased schedule that sets a medium-term goal for removal of the subsidies is necessary in this difficult political environment. The phased schedule must be widely publicised well in advance of price increases, and include a clear explanation of the negative impacts of subsidies on the GOI ability to fund services and infrastructure. This initiative also needs to be accompanied by well targeted social measures. While the higher energy prices have impacted on the poor, they appear to have been ameliorated somewhat by the better targeted direct compensation payments in 2005 and 2008.

Policy co-ordination, decision making and implementation

The GOI has the necessary ministries and agencies of government in place for effective energy policy-making and implementation. But co-ordination, decision making and overlapping/unclear division of responsibilities among these institutions remain serious issues. This situation has been further complicated over recent years by the decentralisation of some administration to the provincial and district governments.

In the central government, a system for co-ordination among relevant ministries exists (i.e. the three co-ordinating Ministries, for Economic Affairs, for People's Welfare, and for Political, Legal and Security Affairs), but it is not clear whether these Ministries have the ability to resolve serious conflicts without the intervention of the President of Indonesia. In the past, energy co-ordination proceeded through the National Energy Co-ordination Board (BAKOREN), which was a ministerial level body chaired by the Ministry of Energy and Mineral Resources. Participating members were a subset of the government's fifteen economic ministries that have special relevance to the energy sector. BAKOREN was generally seen as ineffective and the Review Team strongly supports the establishment of the new National Energy Council, chaired by the President and vice-chaired by the Vice President. The Council provides a much needed mechanism to break logjams and to make decisions at the highest level in a more timely fashion.

It is essential for the effectiveness of the National Energy Council that it receives expert and objective analytical advice and support in its deliberations and decision making. The Review Team recommends the creation of an energy policy unit within the Secretariat of the National Energy Council, within the Ministry of Energy and Mineral Resources. The energy policy unit should also monitor policy implementation with milestones, accountability, and transparency. This is discussed in detail in the Government Policy, Structure and Process chapter. Industry has a strong desire to feel confidence in government policy and its implementation.

Comprehensive, timely, and accurate energy data is the starting point for good energy policy. The multiplicity of statistical sources purporting to show the same (but often very different) energy data demonstrated the underlying need to strengthen the Centre for Data and Information on Energy and Mineral Resources (PUSDATIN) and the data units of each Directorate General and Agency of the Ministry of Energy and Mineral Resources. This would also include establishing the capacity of PUSDATIN to make full use of its data to provide the Ministry with expert energy demand forecasting and long-term scenario analysis.

Indonesia's high energy intensity levels demonstrate the immediate need to implement cost-effective, targeted sectoral and technology energy efficiency programmes. Accurate and comprehensive efficiency indicators for the relevant sectors and technologies are needed to target these programmes. This will require a special and sustained effort in PUSDATIN to build and populate such data. This is discussed further in the Government Policy, Structure and Process chapter and the Energy Efficiency and Conservation chapter.

Energy sector investment

Indonesia's energy sector is crucial to the Indonesian economy, both for earning export revenue and for meeting domestic energy demand. In the past, the focus has been on export revenue, but, since early this decade, there has been a rapid re-orientation by the GOI towards meeting Indonesia's domestic energy needs.

Indonesia has had only limited success in maintaining an attractive investment climate for its energy sector, resulting in insufficient investment to meet fast growing domestic demand and to compensate for declining production from maturing oil and gas fields. GOI legislation in recent years has recognised this shortcoming and has introduced a market orientation to Indonesia's energy sector. This effort has included the corporatising of the state-owned oil and gas company Pertamina, the sale of a portion of the state-owned gas distributor/retailer PGN, and the establishment of upstream and downstream oil and gas regulators, BP MIGAS and BPH MIGAS.

However, domestic and foreign investment in Indonesia's resource rich sector has not been robust. This is due to a mix of issues such as disputes over matters of claimable costings and tax rulings; a lack of transparency and coherence in investment regimes and tendering and approval processes; large parts of the energy sector remaining effectively "monopolised" by state-owned enterprises; high profile disputes over the management of some Production Sharing Contracts (PSC); and subsidised prices and tariffs. While the new Investment Law No. 25/2007 seeks to clarify these issues amongst others, the decisions by the Constitutional Court over the new Electricity Law No. 20/2002 and parts of the new Oil and Gas Law No. 22/2001 have added to uncertainty and sense of heightened risk.

The Review Team's discussions with industry suggested that lack of clarity and transparency due to inconsistency and insufficient details of legislation and poor co-ordination across government are key issues. The new National Energy Council provides a working mechanism for industry concerns to be heard at the highest level. The Review Team recommends that one or two of the Council members represent industry and that the Council periodically consult directly with industry and investors.

In tender and approval procedures, the Review Team recommends clarifying the tender selection criteria and approval standards, using third-party experts for tender evaluations, and providing feedback to unsuccessful tender applicants. Further, it would be advisable to undertake an independent comparison review of Indonesia's investment regime against world best practices.

Independence and authority of energy regulators

A transparently independent regulator that is able to operate separately from the government and consistently in the balanced interest of consumers and the supply industry is essential in a liberalising market. Review Team discussions revealed that many Indonesian energy policy makers consider this a priority for the electricity and

coal sectors, and would also like to see a more independent stance on the part of the oil and gas regulators. The Review Team strongly supports this objective and the need for independent regulation to provide transparency and demonstrable non-discriminatory treatment for all investors and new entrants.

Separation of the regulatory function into an independent authority also helps reassure investors and operators that state interests will not benefit from policy and regulation sitting side-by-side. While the 2001 Oil and Gas Law successfully transferred regulation to separate agencies, there is no such separation in the electricity industry. There is a partial separation in the mining industry, but responsibilities are not clear. This delineation should become more evident when the pending Mining Law is approved.

The decision of the Constitutional Court to annul the entire Electricity Law No. 20/2002 has restricted the possibilities for independent regulation in Indonesia. This being said, the Review Team recommends the development of a transparent timeline for the separation of policy and regulation of the sector and the establishment of a constitutionally acceptable electricity regulator. An interim stage would usefully separate regulation and government policy roles through a restructuring within the Directorate General of Electricity and Energy Utilisation within the Ministry of Energy and Mineral Resources. These issues are discussed in detail in the relevant sectoral chapters.

Energy efficiency

Indonesia's National Energy Policy to 2030 has an economy-wide target of a 1% per year reduction in energy intensity. This may be a difficult task given the need for improved energy services in all parts of the economy and the limited scale of Indonesia's energy efficiency and conservation (EE&C) efforts. Indonesia's EE&C policies are still developing and its challenges are not dissimilar to those in other economies. Best practice policy and programmes can be gleaned from other countries' EE&C programmes.

There are a number of key issues that need to be tackled. First, market-based pricing that reflects the supply and externality costs of a fuel are necessary for a sustainable EE&C programme. The second key challenge for Indonesia is in developing, with its multiple stakeholders, the necessary focus, authority, scale of activity and accountability to enable Indonesia's EE&C potential to be achieved. For this, is the Team recommends that a Directorate General of Energy Efficiency, Conservation and Renewable Energy be established within the Ministry of Energy and Mineral Resources to ensure a strong focus on the demand side that has the authority to garner and mobilise the necessary resources.

Third, cost-effective targeting of EE&C programmes to high wastage industry and technologies is key to EE&C success. This requires a clear quantitative base to the targeting. An energy indicators database using detailed energy end-use data and economic data at the sub-sectoral and technology level is needed and would logically be located within PUSDATIN within the Ministry of Energy and Mineral Resources.

Similarly, while the expertise to understand and plan for longer-term least-cost energy efficiency technology options already exists within the Agency of Technology Assessment and Application (of the State Ministry of Research and Technology) and its MARKAL modelling team, both agencies should draw on international experience in the collection and analysis of energy indicators data and least-cost energy efficient technologies modelling.

Renewable energy in the energy mix

Indonesia's energy demand remains highly dependent on fossil fuels, although there is a huge potential for renewable energy (RE) to play a larger role in the energy mix. For much of Indonesia, with its relatively isolated islands and regions, provision of basic energy needs by RE is an appropriate option. The GOI Energy Blueprint 2005-2025 projects that the share of RE in the primary energy supply will grow from the current 4.3% to 17% in 2025, with RE playing an increasingly important role, particularly for geothermal and biofuels.

The GOI is commended for its efforts to shift policy to accelerate the penetration of RE technologies into the marketplace and to create jobs and generate income by using locally available energy sources. However, the great challenge now is to introduce cost-effective incentives that will attract the necessary investments and bring sustainability to the deployment of RE technology. This would be another task for a Directorate General of Energy Efficiency, Conservation and Renewable Energy in the Ministry of Energy and Mineral Resources.

Keys to sustainability in the deployment of RE technology are the removal of subsidies in fossil fuel retail pricing and electricity tariffs, and the establishment of a regulatory framework that will provide incentives and clarity to investors on issues related to the bidding procedure for new projects and the ongoing taxation and RE feed-in tariffs. The feed-in tariffs for RE systems should be based on the avoided cost as determined by an independent electricity regulatory body, rather than by the state-owned electricity company, PT PLN. This is equally applicable to all RE technologies and the incremental costs of these RE systems should be reflected in the tariff to the local electricity consumer rather than recovered from the government budget.

Indonesia is a key player in the field of biofuels. The production of palm oil has become economically very attractive as prices started to rise rapidly by the end of 2006. The Review Team was very conscious of the domestic and international concerns about the sustainability of this development, particularly from the viewpoint of deforestation and land management policy. Development of a biofuels industry and supply chain continues in Indonesia. Consequently, there is a need for the Ministry of Energy and Mineral Resources and associated ministries to be able jointly to answer critics through the development of a comprehensive policy that aims to create a sustainable biofuels market, taking into account economic, environmental and social considerations.

II. GOVERNMENT POLICY, STRUCTURE AND PROCESS

OVERVIEW

Resources and policy

Indonesia is engaged in a radical transition from a centrally planned economy to a democratic community with partial reliance on liberalised market principles. This transition is bold, imaginative and necessary and it is important that it succeed. In many ways the benefits are already visible. Macro-economic stability has been achieved and growth has been re-established, although not at the necessary level. Indonesia is clearly a more open, confident society than it was before the reforms.

There remains severe poverty in rural areas and on the urban margins, where access to basic services of electricity, water, sewage, transport, trade, education and health are widely deficient. Particularly for the poor, affordability of energy services is low and this has led to a continuation of subsidised energy prices that are well below market levels. Subsidised pricing is a blunt instrument and imposes immense distortions on all of Indonesia's energy sectors: it inhibits and misallocates public and private sector investment, undermines diversification of energy sources and technologies, undermines energy efficiency, reduces enterprises' capacity for environmental compliance, and locks Indonesia into non-sustainable choices. It takes funds from the Government of Indonesia (GOI) that could be used to provide the development services that are essential to economic growth and poverty reduction.

Weak governance deters investors and undermines the provision of services. Indonesian institutions were developed to control a centrally planned economy. Management of its partially liberalised economy depends upon different mechanisms of governance that are based in shared goals, mutual understanding, transparency, financial discipline, and a common analytical language. Progress has been made, but there is still a long way to go.

Indonesia is well endowed with energy resources, although oil production has probably peaked and is now in decline. There is also a substantial resource of coal bed methane, but it is poorly characterised at present and yet to come into the energy mix. Oil dominates the energy mix at 52% with gas at 29%. Energy intensity is high, but not out of proportion given Indonesia's stage of economic development; energy consumption is growing at about 7% per year. The electrification rate is around 60% and it is a priority to extend this.

Table 2.1 ..... Fossil and renewable energy resources, 2007

Fossil energy	Resources	Reserves	Production	Reserves/Production (years)
Oil (billion barrels)	56.6	8.4	0.348	24
Gas (TCF)	334.5	165	2.79	59
Coal (billion tonnes)	90.5	18.7	0.201	93
Coal bed methane (TCF)	453	-	-	-

Renewable energy	Resources (MW)	Installed capacity (MW)
Hydro	75 670	4 200
Geothermal	27 000	1 052
Mini/micro hydro	450	86
Biomass	49 810	445
Solar	4.8 kWh/m²/day	12
Wind	9 290	0.6

Source: Ministry of Energy and Mineral Resources.

Important aspects of energy policy

Energy policy objectives are based on the Presidential Decree No. 5 of 2006 on National Energy Policy and its Blueprint of National Energy Management 2005-2025 (Pengelolaan Energi Nasional - PEN). The recent enacted Energy Law No. 30 of August 2007 that is discussed below creates a National Energy Council chaired by the President with the authority to design and formulate energy policy on behalf of the GOI; the policy then must be endorsed by Parliament. This is a recent development and has not as yet introduced any change in the content of energy policy.

The objectives of the present energy policy are, by 2025:

- To reduce significantly the use of oil to below 20%;
- To increase the use of :
  - coal from 15.7% to more than 33%
  - liquefied coal to more than 2%
  - natural gas from 23% to more than 30%
  - geothermal from 1.9% to more than 5%
  - biofuel to more than 5%
  - other renewable energy (RE) from 0.5% to more than 5%;
- To reduce energy elasticity to below 1; and
- To improve energy infrastructure.

The main programmes envisaged to achieve these targets are all supply-side, namely:

- increasing oil production by optimisation of existing fields, enhanced oil recovery, and offering new acreages;
- development of 10 000 MW of coal fired power plant by 2009; and
- development of bio-energy and opening 6 million hectares of new plantation area for sugarcane, cassava, palm and jatropha.

There are some high financial and environmental risks associated with these programmes and these need further analysis and risk management; there are no fully developed programmes of policy intervention for energy efficiency or for renewables, other than for biofuels. These issues are discussed more fully later.

SOURCES OF LAW

The hierarchy of sources of law in Indonesia is as follows:

- The Constitution of 1945, as amended;
- People's Consultative Assembly (MPR) Resolution;
- Laws enacted by the People's Representative Council (DPR – also called the House of Representatives);
- Governmental regulations;
- Presidential decrees;
- Ministerial decrees; and
- Regional regulations.

Other sources of law include Presidential instructions and circular letters. During the Review Team discussions, it became clear that, at times, there are inconsistencies between specific instruments.

Under Indonesia's legislative system, laws generally present only brief guidelines. Implementing Regulations are written and enacted in subsequent years that determine the detail, and nearly all Indonesian laws depend on these 'operating regulations' and ministerial or presidential decrees to determine exactly how they are implemented.

Principle legislation

Amongst the main laws relating to the energy sector are the following:

- **Energy policy**
  - Presidential Decree No. 5 Year 2006 on National Energy Policy; and
  - Law No. 30 Year 2007 on Energy
- **Oil and gas sector**
  - Law No. 22 Year 2001 on Oil and Gas;
  - Governmental Regulation No. 35 Year 2004 on Upstream Oil and Gas Business Activity; and
  - Governmental Regulation No. 36 Year 2004 on Downstream Oil and Gas Business Activity.
- **Mineral, coal and geothermal sector**
  - Law No. 11 Year 1967 on Basic Provisions of Mining;
  - Law No. 27 Year 2003 on Geothermal;
  - Governmental Regulation No. 32 Year 1969 on the implementation of Law No. 11 Year 1967 on the Basic Provisions of Mining;

- Governmental Regulation No. 75 Year 2001 on the Second Amendment of Governmental Regulation No. 32 Year 1969 on the Implementation of Law No. 11 Year 1967 on the Basic Provisions of Mining;
- Governmental Regulation No. 32 Year 1969 on the Development of Geothermal; and
- Ministerial Decree No. 5 Year 2007 on Preliminary Survey of Geothermal Resource.

Electricity and energy utilisation sector

- Law No. 15 Year 1985 on Electricity;
- Governmental Regulation No. 26 Year 2006 on the Second Amendment of Governmental Regulation No. 10 Year 1989 on Supply and Utilisation of Electricity;
- Governmental Regulation No. 3 Year 2005 on the Amendment of Governmental Regulation No. 10 Year 1989 on Supply and Utilisation of Electricity;
- Governmental Regulation No. 10 Year 1989 on Supply and Utilisation of Electricity; and
- Note also the Law No. 20 Year 2002 on Electrification, later annulled – see below.

'Decentralisation' or regional autonomy

- Law No. 22 Year 1999 on Regional Governance, and its amendment, Law No. 32 Year 2004;
- Law No. 25 Year 1999 on the Fiscal Balance between the Central Government and the Regions, and its amendment, Law No. 33 Year 2004; and
- Governmental Regulation No. 25 year 2000 on the Authority of the Government and the Authority of Provinces as Autonomous Areas.

These laws set out the framework for transferring responsibilities and human and financial resources from central government to the regions.

The broad scope of these laws, regulations, and decrees, etc., is discussed below and additional laws, regulations, and decrees, etc., that relate to specific subsectors are developed in the relevant chapter. Note that references to a law, regulation, and decree, etc., will henceforth use the format of Law No. 22/2001 for Law No. 22 Year 2001.

Judicial review

The Constitutional Court performed judicial reviews of two critical energy laws: the new Oil and Gas Law No. 22/2001, which set out the rules for the reform of Indonesia's oil and gas sector, and the new Electricity Law No. 20/2002, which did the same for electricity. Specifically, the Electricity Law provided for competition, vertical unbundling, and private participation in the electricity sector.

Legislation cannot be scrutinised by the Constitutional Court before adoption of the legislation and the decision of the Court cannot be appealed. The Court, in its judicial review of the Oil and Gas Law No. 22/2001 concluded that the articles regarding authorisation of business activities, the Domestic Market Obligation, and pricing were not legally binding. The original article on pricing had required that pricing of

petroleum products be left to healthy business competition. The Court took the view that the price had to be determined by the GOI.

In December 2004, the Court scrutinised Electricity Law No. 20/2002 and annulled it on the grounds that electricity belongs to a sector of production that is crucially important for the country and has a widespread effect on the life of the people. Therefore the sector must be controlled by the state, it must not be subject to competition, and its business should be conducted by a state-owned enterprise.

The conflict related particularly to Article 33 of the Constitution that mandates the State to control sectors that are vital to the State. In their verdict, the Court took the view that control meant to regulate, facilitate, and operate. This was the first time that the Court had annulled legislation in the economic domain. The Court also determined that the supply of electricity should be integrated and, consequently, not be unbundled into separate businesses as foreseen in the Electricity Law.

The annulment automatically reinstated the defunct 1985 legislation on electricity. The Court instructed the government to enact a new law in compliance with the Constitution. A bill proposing a new Electricity Law is being discussed between the government and the Parliament.

This decision places severe restrictions on the extent to which Indonesia can harness the power of market forces and private capital for the development of its energy sector. It would seem to also prevent a dissociation of price setting from the political arena. This is unfortunate because such linkages engender a chronic tendency to maintain prices below market levels. The judicial decision does not seem to prevent, however, the separation of policy and regulation functions within government, or the development of standardised protocols and methodologies for price formation that would remove some of the arbitrariness of political price setting.

The new Energy Law No. 30/2007 addresses some of these issues. It stipulates that energy prices shall be based on fair economic value and that the central government and regional governments shall create a subsidy fund for poor people. This appears to be a step forward, although it is subject to a wide range of possible interpretations.

Decentralisation

Following the resignation of President Suharto in 1998, Indonesia's political and governmental structures have undergone major reforms. One of these was the introduction of regional autonomy in 1999 according to the Laws No. 22/1999 and No. 25/1999. The decentralisation of power expressed in these Laws was a brave political decision, but the rapidity and severity of the change after the long experience of a highly centralised and controlling government has led to difficulties in interpreting the balance of responsibilities between the central and local governments and has revealed weaknesses in the technical capacity of local administrations. Law No. 22/1999 authorises local governments to regulate and manage many affairs of local communities, including the authority to formulate local energy policies and plans.

There has also been a radical reallocation in the sharing of revenues between the central and local Governments. Law No. 25/1999 on the Fiscal Balance between the Central Government and the Regions assigns to regional administrations 15% of the net revenues from oil and 30% of the net revenues from natural gas. The GOI's net oil and gas revenues refer to profit after cost recovery and deduction of the Production Sharing Contract (PSC) share. Of the 15% of the oil revenue flowing to the regions, 6% will go to the regency of origin (where the PSC 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 formula of 20% for the central government, 16% for the provincial government, 32% for the district government, and 32% disbursed across the other district governments in the same province. This is discussed more fully in the Coal chapter.

Law No. 22/1999 has since been amended by Law No. 32/2004, and Law No. 25/1999 has likewise by Law No. 33/2004. These amendments redress some of the strengths conferred on local governments and enable decision making for a commodity that is becoming more nationally strategic to be taken from the authority of local governments and referred to a higher level of government.

There are thirty-four provinces in Indonesia of which four (Aceh, Jakarta, Yogyakarta, and Papua) have greater legislative privileges and a higher degree of autonomy from the central government than the others. Each province has its own political legislature and governor. The provinces are subdivided into districts, which are further subdivided into sub-districts and again into village groupings. The 440 districts or regencies have become the principal administrative units, responsible for providing most government services.

The amended laws bring some clarification of responsibilities. The responsibilities and authority of the central government in the energy sector include:

- the issuance of laws;
- the stipulation of national policy;
- the stipulation and implementation of standards; and
- the stipulation of procedures.

The responsibilities and authority of the provincial governments in the energy sector include:

- the issuance of provincial regional regulations;
- the fostering and supervision of operations within their jurisdiction; and
- the stipulation of policy of management within their jurisdiction.

The responsibilities and authority of the district/city government in the energy sector are, among others:

- the issuance of district/city regional regulations;
- the fostering and supervision of operations in districts and/or cities; and
- the stipulation of policy of management in districts and/or cities.

Procedures for constructing laws and regulations

Preparation for legislation follows a procedure set by government. The initiating ministry forms an interdepartmental team comprising representatives from other ministries that have concerns relevant to the proposed laws and/or regulations. The initiating ministry prepares the conceptual proposal and the draft bill or regulations. These are then sent to the Ministry of Laws and Human Rights (MLHR). Other ministries with conflicting interests will give their legal views and MLHR will harmonise the differences. If the differences remain irreconcilable, the President will arbitrate.

In the light of the results from this process, the initiating ministry and MLHR will rewrite the draft law or regulations and the initiating ministry will propose it to the President through the State Secretary. The President will submit the bill to the legislature. The legislature will scrutinise the bill in committee. This task falls at present to the responsibility of Commission VII of the Indonesian Legislative Assembly. The Committee may take expert advice. The Bureau of Legal Affairs in the initiating ministry will work with the Committee and develop a new draft. This is then submitted to the Indonesian Legislative Assembly. After adoption, the Minister of Laws and Human Rights authorises and registers the legislation in the State Gazette.

This procedure is procedurally satisfactory and adequately resourced, but it lacks effective mechanisms for participation by stakeholders outside government. The application of this procedure to the Electricity Law No. 20/2002 has been studied in detail by the Indonesian Institute of Energy Economics (IIEE).[1] The study revealed that in the preparation of legislation, there was limited participation by the public. Public involvement was limited to select organisations or individuals who were invited to participate. Selection of specific groups for privileged consultation distorts the process and reduces consensus and support for the product. In the scrutiny of the legislation, there is a consultation process open to the public. However, according to the IIEE, very limited information was made available and, consequently, few people were fully aware of the proposed legislation.

The IIEE study found that "in principle, all documents available at the DGE&EU (Directorate General of Electricity and Energy Utilisation, MEMR) are open to the public. However, there is no procedure explaining how the public can access information from DGE&EU. If one requests a document officially and DGE&EU decides that the document is unrestricted, then the document can easily be obtained. On the other hand, DGE&EU does not have any guidelines about document confidentiality; this means that the documents status as confidential or accessible to the public is completely at the discretion of DGE&EU officials."

The government did make a distinct effort to sensitise the public to the need for power sector reform. An element of a related Asia Development Bank (ADB) loan was allocated for building public awareness and engagement in the process. A

1. *Electricity Governance Initiative: Case of Indonesia,* Indonesian Institute of Energy Economics, World Resources Institute, 2006.

multi-stakeholder Working Group on Power Sector Restructuring was established, but according to a detailed account of events by the World Resources Inc., "International NGOs questioned the ADB's emphasis on gaining acceptance of policies rather than civil society participation in the policy-making process."[2]

It appears that draft laws still do not circulate outside the government. The IEA Review Team was unable to procure a copy of the draft Energy Law before its ratification. The consequence is that organisations outside government cannot effectively scrutinise or contribute to proposed legislation, policy and programmes. This is counter to the ideals of a pluralistic and democratic society. Excluded groups include environmental and social NGOs, consumer groups, industrial interests, and representatives of other private interests. The absence of this scrutiny is a loss because ideas cannot then be broadly tested, public welfare is not advanced, and the public has no ownership in the draft legislation or the procedure. An opportunity to build public support is lost.

Subsequent comments received from MEMR indicated that the law and regulation making process is open to public participation, with all materials usually being available on the MEMR website or that of the respective Directorate General.

The new Energy Law

An Energy Law No. 30/2007 was ratified in August 2007. It is a comprehensive law that:

- establishes a National Energy Council (and Secretariat), chaired by the President of Indonesia;
- defines procedures to elaborate a National Energy Master Plan and Regional Energy Master Plans;
- establishes rules for management of energy resources, including energy conservation; and
- clarifies the authorities of the central and local governments.

The duties of the National Energy Council are to design and formulate national energy policy, to decide measures to manage energy crises and emergencies, and to monitor the implementation of energy policy that is cross-sectoral in nature.

The senior management of the National Energy Council is constituted from the Chairman (President of the Republic of Indonesia), Vice-Chairman (Vice President of the Republic of Indonesia), and Executive Chairman (Minister of Energy).

The members of the Council will be seven representatives from the ministries directly responsible for supplying, transporting, distributing and utilising energy; and eight

2. "Indonesia: Electricity Reform under Economic Crisis", Chapter 5, *Power Politics,* World Resources Institute, 2002.

representatives from stakeholders. Ministerial members will be appointed by the President and the others will be selected by the House of Representatives.

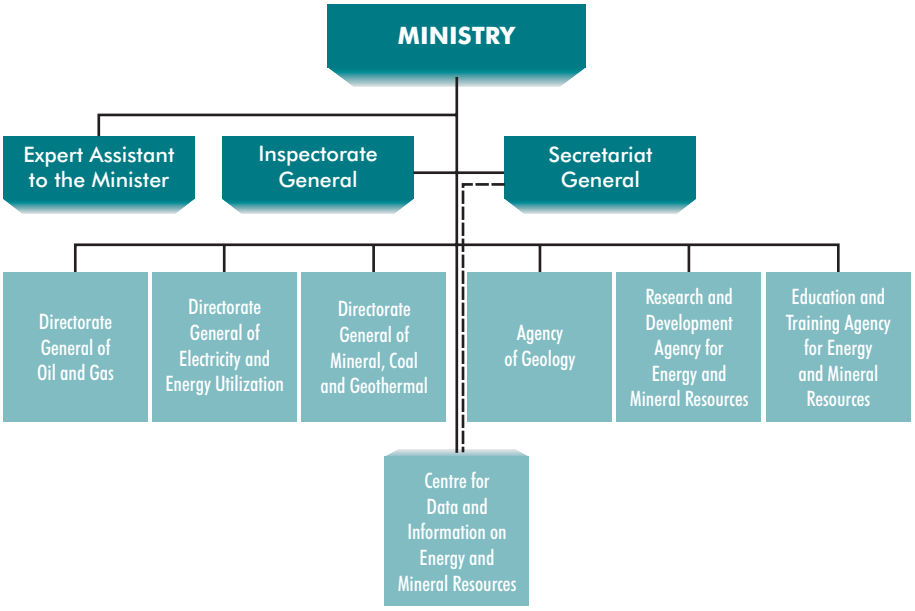
AGENCIES OF GOVERNMENT

Ministry of Energy and Mineral Resources

Organisation

Immediate responsibility for Indonesia's energy policy lies with the Ministry of Energy and Mineral Resources (MEMR).

Figure 2.1 ..... Organisation of the Ministry of Energy and Mineral Resources (MEMR)

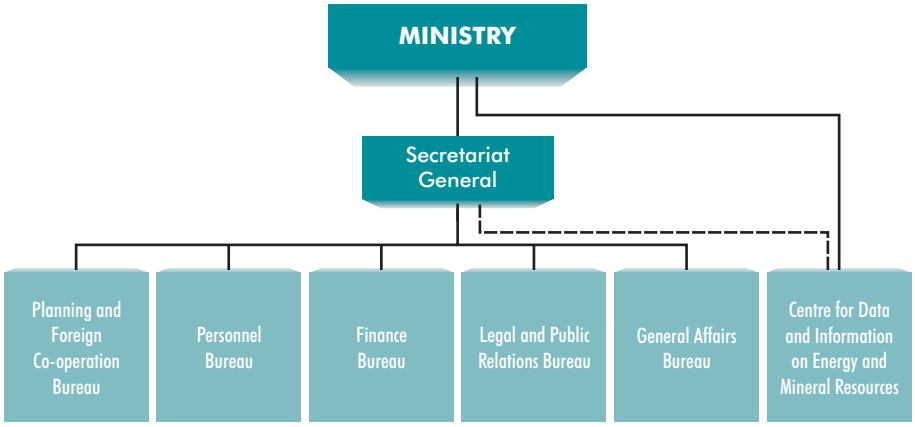


Source: Ministry of Energy and Mineral Resources.

There are three Directorates General for managing policy, implementation and supervision across the energy sector, namely the Directorate General of Oil and Gas, the Directorate General of Electricity and Energy Utilisation, and the Directorate General of Minerals, Coal and Geothermal. There are also three Agencies managing energy and minerals research and development, geology resource assessment, and for energy and minerals education and training.

Central services in Planning, Legal Affairs, Finance and Information are provided by Bureaus within the office of the Secretary General. Also within the office of the Secretary General is the Centre for Data and Information on Energy and Mineral Resources (PUSDATIN).

Figure 2.2 ..... Organisation of the Secretariat General, MEMR



Source: Ministry of Energy and Mineral Resources.

PUSDATIN is a relatively new agency under MEMR. It is responsible for the information technology needs of MEMR and recognises the need for MEMR to have a centralised point for MEMR data and information collation, storage and dissemination. PUSDATIN also maintains the MEMR website and continually improves the information technology (IT) infrastructure and resources of MEMR.

Comprehensive, timely, and accurate data is the starting point for rational policy, and PUSDATIN is taking an increasing role in data analysis and longer term forecasting. Its officials demonstrated a responsible interest and capacity to lift MEMR's statistical capacity. In co-ordination with the statistical units of each MEMR Directorate General, it is worth considering what capacity enhancement is required to enable PUSDATIN to fully acquit its charter.

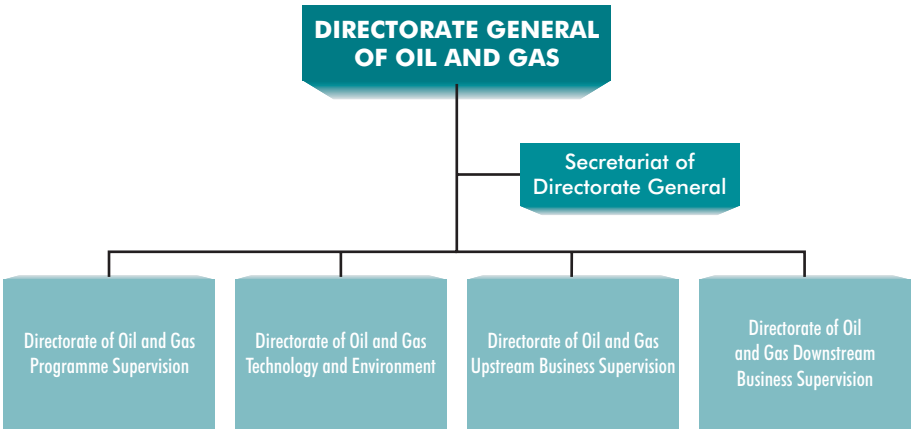
Directorate General of Oil and Gas (DGO&G)

Prior to 2001, all oil and gas affairs were the responsibility of the state-owned enterprise, PT Pertamina, under the Oil and Gas Law No. 44/1960 and the Law for Pertamina No. 8/1971. In October 2001, the Legislative Assembly adopted the Oil and Gas Law No. 22/2001 and this law separated the policy, licensing, and regulatory functions from Pertamina and assigned them to different institutions. The responsibility for policy was assigned to the Directorate General of Oil and Gas (DGO&G) of MEMR.

DGO&G is the executive body responsible for sectoral planning, policy, and industry development for oil and gas upstream and downstream, including employee training and promulgating regulations. It manages this via its four Directorates:

- Oil and Gas Programme Supervision;
- Oil and Gas Technology and Environment;
- Oil and Gas Upstream Business Supervision; and
- Oil and Gas Downstream Business Supervision.

Figure 2.3 ..... Organisation of the Directorate General of Oil and Gas, MEMR



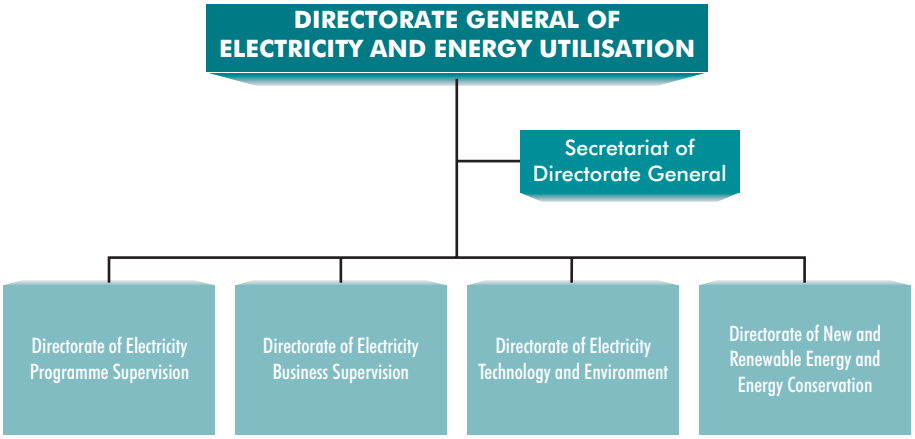
Source: Ministry of Energy and Mineral Resources.

Directorate General of Electricity and Energy Utilisation (DGE&EU)

The Directorate General of Electricity and Energy Utilisation (DGE&EU) is primarily responsible for electricity sector policy and for its regulation. The distinction in these different responsibilities is not clearly reflected in the structure of the Directorate General. The Directorate General is divided into three electricity focussed Directorates, namely Electricity Programme Supervision, Electricity Business Supervision, and Electricity Technology and Environment. It also has a Directorate of New and Renewable Energy and Energy Conservation.

DGE&EU electricity sector functions are still a mix of policy and regulation. The Electricity Law No. 20/2002 proposed to establish a partly independent regulatory authority and required that "the Regulating Board shall make decisions independently and make a transparent clarification regarding all of the considerations in its decision-making". The details of how this was to be done were deferred to later legislation.

Figure 2.4 ..... Organisation of the Directorate General of Electricity and Energy Utilisation, MEMR



Source: Ministry of Energy and Mineral Resources.

It seems that little attention was given at that time to the governance challenge of developing the regulatory function, independent or otherwise, and there seems to have been no evolution of thinking after the annulment of the Electricity Law No. 20/2002 by the Constitutional Court.

It would seem more appropriate to separate the electricity sector functions of the Directorate General first into policy and regulation, and then to further sub-divide the regulatory functions, perhaps to apply to the separate businesses of generation, transmission, distribution, and retail. This reform would be a useful move, even if no independent regulator can be created in the short term. It would enable a conceptual separation of policy and regulation and would support separate analysis of the capital structure and economic behaviour and management of the different businesses, so contributing to better price formation and transparency. This would be reinforced by further subdividing the Directorate for regulation into units for generation, transmission, distribution and retail. It would also be a positive step to increasing investor comfort.

Energy efficiency and renewable energy are also covered by the DGE&EU. Energy efficiency and renewables energy options appear in the energy policy as important contributors to achieving an energy balance in 2025, and there are ambitious policy objectives for both. However, there is a contrasting absence of real policy initiatives based in operational and enforceable regulations and effective, fully funded financial incentives. This policy gap in these important areas is probably a consequence of several factors, to which a shortage of trained personnel in policy and economics may contribute.

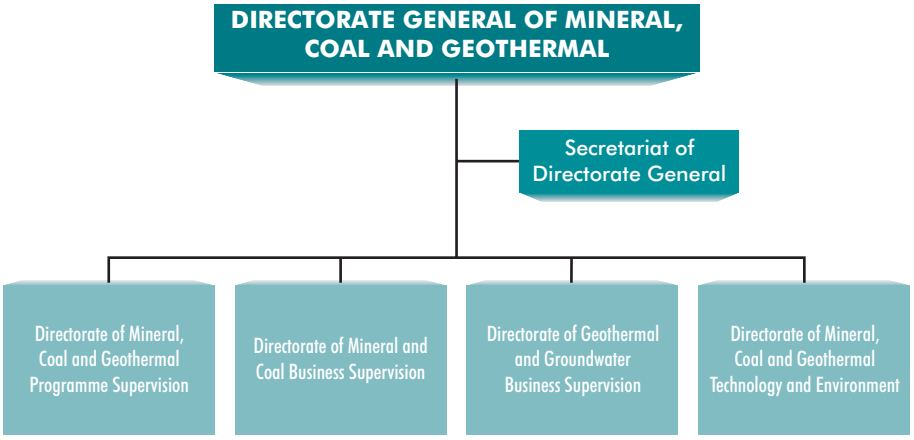
It may also be a consequence of the overshadowing of the nascent efficiency and renewable industries by the giant electricity industry with all its immediate problems. The high importance and extensive policy needs of energy efficiency and renewable energy options are not at present reflected in the institutional structure where both are covered by a single Directorate within DGE&EU. A more prominent position is advisable. A Directorate General for Energy Efficiency and Renewables might be considered. This is discussed in the Renewable Energy and the Energy Efficiency and Conservation chapters.

Directorate General of Minerals, Coal and Geothermal (DGMC&G)

Policy for the minerals, coal and geothermal industries is the responsibility of the Directorate General of Minerals, Coal and Geothermal (DGMC&G).

The mining sector is regulated principally by the Basic Mining Law No. 11/1967 whose provisions cover the classification of minerals, the form of organisations eligible to engage in mining, and the legal basis for mining activities. This law is amended by the Governmental Regulation No. 75/2001. Environmental regulation proceeds through a variety of agencies (see the Energy and Environment chapter). 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 contract of work (COW) from MEMR. A company enters into a partnership agreement with the GOI, but operates the mine independently of the GOI (see the Coal chapter).

Figure 2.5 ..... Organisation of the Directorate General of Minerals, Coal and Geothermal, MEMR



Source: Ministry of Energy and Mineral Resources.

The DGMC&G is also responsible for ensuring that the coal required by coal-fired power plant will be available in a timely manner and that the transport facilities for moving the coal from the mine to the power stations will be in place. This latter task it performs in co-ordination with the Ministry of Transportation and the Ministry of Home Affairs and Local Government.

The legislation for regional autonomy, Law No. 32/2004, retained the ownership of mineral rights in the state, but 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.

A proposed new law on mining of minerals and coal is now in preparation. A previous draft was rejected by Parliament. The aims to the new law will be to:

- clarify central government, provincial and district authority responsibilities;
- strengthening of central government authority on mining activities currently under the control of local governments;
- establish mining zones and mining estates;
- establishing a "State reserve" for the special national interest;
- permit foreign mining companies to have an agreement with the state-owned mining company/representative agency to develop the "State reserve";
- revise the mining license system, and eliminate direct contract between the mining company and the GOI;
- simplify licensing permits for exploration and exploitation;
- establish procedures to determine mining areas through bidding;
- focus community development on the welfare of local people;
- require processing and refining of produced metal to be established in Indonesia; and
- honour existing licenses and agreements.

Agencies for Research and Development, for Geology, and for Education

Within MEMR, the Agency for Research and Development co-ordinates four specialised R&D centres, namely Lemigas (oil and gas technologies), P3TEK (new and renewable electricity technologies, including energy efficiency), tekMira (mineral and coal technologies), and PPPGL (the marine geological institute).

The Agency for Geology within MEMR has responsibility to research and assess Indonesia's geological resources and to promote its sound management. The Agency co-ordinates four specialised centres, namely the Centre for Geological Resources, the Centre for Volcanology and Geological Disaster Mitigation, the Centre for Environmental Geology, and the Centre for Geological Survey.

The MEMR Agency for Education and Training (ETA) has a similar structure to the Agency for R&D. It is the lead actor in energy training and is also responsible for co-ordinating MEMR's wider capacity development. The Agencies are discussed in detail in the Research and Development and Training chapter.

Implementing Body for Oil and Gas Upstream Operations (BP MIGAS)

The new Oil and Gas Law authorised the creation of an upstream implementation agency. In 2002, Governmental Regulation No 42/2002 established an Implementing Body for Oil and Gas Upstream Operations (Badan Pelaksana Minyak dan Gas Bumi - BP MIGAS). BP MIGAS took over responsibility for the business regulatory functions of Pertamina, including the issue of licences and the management of Production Sharing Contracts (PSCs) with private companies. This effectively removed Pertamina's clear conflict of interest in regulating the activities of its competitors.

Pertamina itself was transformed into a limited liability company PT Pertamina (Persero) by Presidential Decree in 2003. Ownership of Pertamina remains at present with the state (see Ministry of State Owned Enterprises below). Commissioners were appointed to oversee internal reform of the company and the intention is to partially privatise the company at some point through a public offer.

BP MIGAS has managed upstream regulatory activities since mid-2002. However, it lacked implementing regulations until 2004 when the GOI issued Regulation 35/2004 under the Oil and Gas Law No. 22/2001. The main responsibilities of BP MIGAS are to:

- provide recommendations to the Minister in preparing and offering work areas and co-operation contracts;
- sign co-operation contracts;
- control upstream business operations; and
- appoint sellers of the GOI's share of oil and gas. BP MIGAS is a non-profit State legal entity and acts on behalf of the GOI as party to the co-operation contract with business entities. At the same time it also controls all oil and gas business operations.

BP MIGAS is led by a chairman and vice chairman, assisted by five expert staff and four main operational divisions: planning, operations, finance and marketing, and general affairs. The chairman is appointed by the President, based on the recommendation of the Minister of Energy and Mineral Resources after approval by the House of Representatives (DPR). The Chairman must periodically report to the President (every six months or as requested), via the Minister of Energy and Mineral Resources. BP MIGAS must also report and gives copies of signed Production Sharing Contracts to the House of Representatives (DPR).

Regulatory Body for Oil and Gas Downstream (BPH MIGAS)

The new Oil and Gas Law officially removed the monopoly of Pertamina downstream and attributed the responsibility to regulate, develop and supervise the downstream oil and gas industry and retail fuel distribution and supply to a downstream regulatory agency, the Regulatory Body for Oil and Gas Downstream (Badan Pengatur Hilir Minyak dan Gas Bumi - BPH MIGAS). DGO&G continues to be responsible for technical regulation.

However, BPH MIGAS lacked implementing regulations until 2004 when the GOI issued Governmental Regulation No. 36/2004. BPH MIGAS' broad responsibilities are to:

- regulate and determine the supply and distribution of oil-based fuel;
- regulate the transmission and distribution of natural gas;
- allocate fuel to meet national fuel oil reserve goals;
- plan the use of oil and gas transportation and storage facilities;
- set gas pipeline tariffs;
- set natural gas prices for household and small consumers;
- recommend pipeline levies; and
- set the price of pipeline rights.

BPH MIGAS has the regulatory and development responsibilities to:

- formulate strategic reserves policies;
- ensure the availability and distribution of fuel oil;
- monitor reserves, market share and trading volumes;
- determine price formulas for subsidised fuel;
- protect occupational health and safety;
- ensure environmental protection; and
- promote community development.

BPH MIGAS is a smaller body than BP MIGAS; it comprises a committee of nine (one chairman and eight members) appointed by the President, based on the recommendation of the Minister of Energy and Mineral Resources after approval by the House of Representatives (DPR). The chairman must periodically report to the President (every six months or as requested), via the Minister of Energy and Mineral Resources.

Ministry of State Owned Enterprises

It is proper practice in governance that the ownership of state enterprises should not be within the responsibility of the relevant sector/policy ministry. The functions of ownership and policy making are different. Additionally, the state would normally establish broad policy parameters within which state owned enterprises should operate, it would assess the performance of the enterprises against broad policy settings, and it would receive dividends and monitor financial performance to ensure that the enterprise's management was efficient. It would not intervene in day-to-day management or operational policy.

For Indonesia, this pure separation of roles is a little confused by the need for subsidy. Law No. 19/2005 regulates state-owned enterprises and stipulates that every public service obligation (PSO) should be approved by the Ministry of Finance, the sector Ministry, and the Ministry of State Owned Enterprises. It is not clear whether this approval is ever withheld. The Ministry of Finance has taken a consistent line against subsidies, but they remain in place, albeit with slow modification. The Law No. 19/2005 requires that, for every PSO laid upon an enterprise, there should be adequate compensation by the GOI. The Ministry of State Owned Enterprises is the vehicle by which the transfers are made.

These transfers are enormous and represent a large fraction of the annual state budget. For 2008, the Ministry of Finance had projected a compensation for oil product subsidies of around Rp 43 trillion to Pertamina and of around Rp 28 trillion to PT PLN to compensate for subsidised electricity prices. (It is interesting to note that the international oil price rise in the early months of 2008 increased this forecast 2008 payout to around Rp 130 trillion and Rp 60 trillion respectively, thus forcing an increase in subsidised prices of some 30%.). The estimates of the budgetary allowances required each year are mainly supplied by the Ministry of State Owned Enterprises. This does give to this Ministry considerable influence over the enterprises.

Ministry of Finance

The main role of the Ministry of Finance is now in raising revenue. It previously supervised the state-owned enterprises and set the appraisal rules for investment. After the ownership function was transferred to the Ministry of State Owned Enterprises, the Ministry of Finance ceased to exercise this control. It considers that it now has little influence over the expenditure of revenues and none at all over the efficiency of this expenditure. In particular, it is no longer close enough to the companies to distinguish whether capital contributions from line ministries go to genuine investment or are used to cover operating inefficiencies. State-owned enterprises do not require approval of the Ministry of Finance for borrowings, including foreign borrowings.

In these circumstances, it is hard to see why any of the agents directly involved in the subsidy process should make any effort to manage the problem. As long as subsidies are forthcoming from the GOI, the line ministries and the Ministry of State Owned

Enterprises have little incentive to change their practice. The Ministry of Finance, which has the task of raising the money, is too far removed to have much influence. There seems to be a case for reviewing the entire management of the PSO process.

There does not seem to be a tradition in Indonesia of movement of officials between ministries. This is logical in an environment where the function of ministries is to ensure the technical implementation of a centrally planned and co-ordinated economy. It is, however, inappropriate in a more liberal environment, where co-ordination depends in part on common understanding and a shared language and principles. Typically, Ministries of Finance in particular use the practice of movement of officials between ministries to gain understanding of the policy issues in line ministries and to transfer the language and ideas of financial discipline. The GOI might consider experimenting with this practice.

PLANNING

The planning cycle

Indonesia was for many years, and to a certain extent still is, a centrally planned economy. Accordingly, it has a well developed planning system, managed by the National Development Planning Agency called BAPPENAS (Badan Perencanaan Pembangunan Nasional), which originates in the Constitution and has been built over many years at a time when most of the economy was in the hands of state enterprises.

The main element of the system was a series of five year plans and this is still the case. However, the nature of the exercise has moved slightly in the direction of a more indicative planning approach as partial liberalisation has weakened control over some important industries, notably oil, gas, and coal in the energy sector. The national planning process is now based on Law No. 25/2004 regarding the National Development Planning System.

The starting point is the comprehensive Long-term Development Plan for the national economy over the period 2005-2020. From this is developed a National Medium-term Development Plan for 2004-2009. Sectoral policies and strategies are established from the Medium-term Development Plan and, from this mid-term strategy, one-year operational plans are determined annually within each ministry.

Long-term National Development Plan

The Long-term National Development Plan provides direction and a reference for all national entities, government, social and private so that efforts are synergic, complementary and co-ordinated. The National Plan is produced by BAPPENAS in collaboration with the Legislative Assembly and the President.

Medium-term National Development Plan

The Medium-term Development Plan is based on the Long-term National Development Plan, in particular Article 19 of the Law No. 25/2004 that contains the vision, mission and programmes of the President for development over the next 5 years. The Plan is

to be implemented through the Basic Strategy that includes the main objectives and the principal directions of policies and programmes.

Medium-term Strategic Plan for Sectors

The Medium-term Strategic Plan for the energy sectors has been prepared in the past by the Bureau of Planning within the office of the MEMR Secretary General on the basis of the national Medium-term Development Plan. It is approved by the Co-ordinating Ministry, BAPPENAS, and the Ministry of Finance.

The Bureau liaised with the operating companies and each Directorate General within MEMR to produce plans for each industry which it consolidated into a sector plan. MEMR then sent the results to BAPPENAS where they were reviewed and assessed against competing demands from other sectors. The decision was then returned to MEMR where the Bureau of Planning within MEMR transformed them into operating plans for the companies and transmitted them to the companies. On the basis of this work, an indicative budget for the MEMR was elaborated over the period.

Under the 2007 Energy Law, the National Energy Master Plan will be formulated by government according to a Presidential Decree that has yet to be stipulated.

Annual Plan

The MEMR Bureau of Planning makes each year an Annual Plan which is essentially a budget for expenditures within the Ministry and governs the allocation of the money to be disbursed to the industries through MEMR.

Implementation of plans

Central planning is effective in environments where all factors are under the direct control of state institutions and where those institutions obey instructions. However, even a modest participation of private interest and uncontrolled public or private activity can upset the calculations. For example, if oil and gas producers choose to export, rather than sell to the domestic market, this can affect all targets elsewhere. The tendency then is to introduce new and arbitrary controls to bring the system back into balance, such as the Domestic Market Obligation on oil and gas. Such arbitrary interventions do not address the underlying issue that market conditions conflict with the policy.

Delivery cannot be guaranteed by programmes that are only partially within the control of the state, and this is compounded by an absence of detailed analysis of market behaviour under existing conditions and of how actors will respond to particular interventions. The technical analysis and modelling that goes into the development of a plan cannot satisfactorily replace such detailed economic analysis of the behaviour of market participants.

Hence, the consequence of current policy planning and implementation is that the objectives of the energy policy, although plausible when considered in isolation, are not linked to clear programmes and their implementation. Within their implementation, there needs to be identification of instruments, assignment of responsibilities, and

specification of timelines and performance criteria that will ensure their successful outcome, along with realistic monitoring.

Examples of programmes that are in some difficulties are:

- the 10 000 MW Fast Track/'Crash' programme, the justification for which is incomplete and the implementation of which is not adequately spelt out;
- programmes to achieve renewables and energy efficiency targets where there are no identified interventions along with budgets, responsibilities and schedules; and
- the Biofuels Programme where a basic cost-benefit analysis has not been undertaken to examine likely price behaviour of biofuel on international markets, the cost-effectiveness of sales on the Indonesian market, and the consequent risks for domestic processing investment in Indonesia. Nor has a risk-management strategy been proposed.

CO-ORDINATION

National Development Planning Agency (BAPPENAS)

BAPPENAS has adequate measures for co-ordination. One level of co-ordination is performed within the planning cycle by BAPPENAS. National targets are established by BAPPENAS in consultation with interested parties and political authorities. Available resources are then allocated by BAPPENAS to achieve these targets, with co-ordination between various inputs and outputs being assured by technical analysis.

The problem, as noted earlier, is that the initial targets are not necessarily realistic and the powers to impose the planning solutions on a partially free market are lacking. Implementation then becomes a problem.

Co-ordinating Ministry for Economic Affairs

Another level of co-ordination is made by the Co-ordinating Ministry for Economic Affairs. The GOI has three co-ordinating ministries, the others are for security and for welfare. These co-ordinating ministries report directly to the President and Vice-President. The co-ordinating ministries appear to have little direct influence on policy; their tasks are fundamentally to simplify the problems of managing the views and activities of the fifteen co-ordinated ministries. Matters that affect a single ministry are dealt with without reference to the co-ordinating ministry, whereas matters that affect more than one ministry will be managed through the co-ordinating ministry.

Fifteen ministries, including the Ministry of Finance, come under the co-ordination of the Co-ordinating Ministry for Economic Affairs. The functions of the Co-ordinating Ministry for Economic Affairs are planning and policy development, synchronisation and control, implementation, and education.

The Co-ordinating Ministry reconciles divergent views on policy, programmes and legislation, and will also follow the implementation of significant programmes, *e.g.,* it chairs the implementing team for the 10 000 MW programme. It will prepare legislation that affects several ministries.

The Co-ordinating Ministry participates in the formulation of the state budget. The Ministry of Finance prepares the budget in consultation with BAPPENAS and on the basis on the Annual Plan prepared by BAPPENAS. This budget is then transmitted to the Co-ordinating Ministry for submission to the Cabinet. Subsequently, it is presented to Parliament by the Ministry of Finance who may adopt it by passage of a budget law.

National Energy Co-ordination Board (BAKOREN)

In the past, energy co-ordination proceeded through the National Energy Co-ordination Board (Badan Koordinasi Energi Nasional – BAKOREN), which was a ministerial level meeting chaired by MEMR and with a secretariat within DGE&EU. The participating members were a subset of the GOI fifteen economic ministries that have a special relevance to the energy sector. BAKOREN appears to serve largely as a forum in which the participating ministries work out their position with respect to the Co-ordinating Ministry for Economic Affairs.

It does not appear to have had a significant role in co ordination in practice, although the Energy Policy to 2015 apparently originated from BAKOREN. The proposal then came to the Co-ordinating Ministry for Economic Affairs which then organised discussion with other parties and put the agreed position into the form of a Presidential Decree. BAKOREN was generally seen as ineffective. The new National Energy Council will now take over the co-ordination duties and BAKOREN will cease to exist.

Conclusions and recommendations

It is not unusual within centrally planned economies that engineering disciplines and perspectives are the norms, while business, economic, and social studies are of marginal application. The political transition, in which Indonesia is now engaged, requires a parallel intellectual and professional shift towards these ideas. This is a long transition because it can only be fully accomplished at early stages in the educational system.

It is palpable from the open and engaged approach of the professional staff in MEMR that they have absorbed, and do reflect, many of these ideas. The same capacity to absorb and apply in the right circumstances is plain in the success of private sector initiatives within and outside the sector. However, it is equally clear from the flaws identified in existing sector programmes and the relative tolerance of the immense economic distortions evident throughout the energy sector that this intellectual familiarity does not penetrate deeply into practice. The conflicting interests of stakeholders means

that there is a strong need for the MEMR to take the lead for more open debate on energy policy and a more open decision-making process.

Planning in the energy sector would benefit from coherent analytical support to policy formulation through the creation of an energy policy unit. The functions of this unit would include:

- Assessments, analysis, forecasting, and explanation of national, regional, and international energy market trends, behaviours, and developments;
- Identification of options for intervention by the GOI in energy policy and major associated policies (*e.g.* transport, construction, environment), analysis of the impacts of those options on affected groups, determination of performance criteria, and identification of preferred options;
- Analytical support to demand-side options, alongside traditional supply-side ones, by developing analysis of barriers, opportunities, potentials, and costs and benefits of various supply and demand options; and
- Analytical support to the development of energy efficiency, renewables, and rural programmes.

This unit should be located within the Secretariat of the National Energy Council within the Ministry of Energy and Mineral Resources.

The strengthening of policy analysis would also strengthen co-ordination, by providing a common language. In the absence of rigorous analytical disciplines, co-ordination is a confrontation of conflicting results and is arbitrary. Structured analysis allows confrontation of assumptions and this is easier to reconcile.

The energy policy unit would have an additional highly significant role. The energy sector's transition from centrally planned to a more liberalised and competitive market has seen much change and there is significant restructuring still to be achieved. Review Team discussions with industry highlighted the need for the GOI to monitor and report openly on the speed and the success, or otherwise, of implementing agreed energy policies and programmes. There was clearly a desire on the part of industry to feel a confidence in government policy and its implementation.

Comprehensive, timely, and accurate energy data is the starting point for rational energy policy. The Centre for Data and Information on Energy and Mineral Resources (PUSDATIN) is a relatively new agency under MEMR with responsibility for Indonesia's centralised and co-ordinated energy data and information collation, storage and dissemination.

Review discussions and the multiplicity of statistical sources purporting to show the same (but regularly very different) energy data demonstrated the underlying need to strengthen PUSDATIN. This would be done in co-ordination with the data units of each MEMR Directorate General and Agency, and would include establishing the capacity of PUSDATIN to make full use of its data to provide MEMR with expert energy demand forecasting and long-term scenario analysis.

Indonesia's energy intensity levels demonstrate the immediate need to better understand and implement targeted sub-sectoral energy efficiency programmes. Such targeting requires a special and sustained effort in PUSDATIN to build accurate and comprehensive energy efficiency indicators and to develop their policy implications.

A particular feature of a liberalised utility market is the role of the independent regulator. It is clear from discussion within MEMR that officials are well aware of the importance of the concept and of the critical part that separation of regulation from policy must play, especially in providing transparency and giving assurance to investors.

Separation of the regulatory function into a genuinely independent authority helps reassure investors and operators that policy will be implemented in a non-discriminatory way and, in particular, that state interests will not benefit from advantages that are obscured by a foggy confusion of policy and regulation. Practice, however, does not fully match that theoretical grasp. While the 2001 Oil and Gas Law successfully transferred regulation to separate agencies, there is no such separation in the electricity industry. There is a partial separation in the mining industry, but responsibilities are not clear. This should become more evident when the pending Mining Law is approved.

The decision of the Constitutional Court, to annul parts of the Oil and Gas Law No. 22/2001 and the entire Electricity Law No. 20/2002, has restricted the possibilities for independent regulation. Improved transparency of the electricity industry and separation of regulation and government policy roles would be achieved, however, if DGE&EU were restructured into separate Directorates for electricity industry policy and for electricity industry regulation. This could be an initial step toward eventual separation of the electricity regulatory function into an independent administrative unit under constitutionally acceptable governmental control.

MEMR has made a great advance in its communication with the public through its website, but this needs to be extended to systematic consultation before policies and programmes are developed.

Similar considerations apply to communication and dissemination to foreign interests. Indonesia competes with other countries to attract investment and it should go out of its way to make that environment attractive, especially in ways that incur little cost. Making information easily available in English is one way of doing that.

The IEA Review Team recommends that the Government of Indonesia:

- Strengthen energy policy co-ordination across energy policy agencies, and between energy policy and other government agencies, including the Ministry of Energy and Mineral Resources (MEMR), and the Ministries of Finance, Environment, and Forestry.
- Better coalesce national energy policy responsibility into the Ministry of Energy and Mineral Resources (MEMR), and clarify the roles and responsibilities of each energy policy entity to minimise overlap.

■ Define and establish methods and lines of accountability for implementing energy policies for agencies and staff by:

- Setting clear objectives;
- Setting work plans, including dates for delivery of the desired objectives;
- Independent auditing of outcomes against objectives and work plans; and
- Ensuring personal and organisational accountability.

■ Introduce a timetable for the phased removal of price subsidies across the energy sector:

- Widely publish the timetable well in advance of the price increases and link reduced energy subsidies with direct funding for social services that has visible public benefits, particularly for Indonesia's low-income population; and
- Launch a national awareness campaign to give the public clear information on how reduced subsidies and higher energy prices over the longer term will improve the economy and the standard of living.

■ Improve existing government structures and processes by:

- Completing the separation of policy, regulation, and operational functions, particularly in the electricity sector;
- Establishing independent and empowered regulators in the energy sector, particularly in the electricity sector; and
- Upgrading the status of energy efficiency, conservation, and renewable energy in MEMR, such as by creating a new Directorate General, with clear lines of communication with the Ministry for the Environment and other relevant entities.

■ Empower stakeholders and the community by:

- Improving communications with investors through adequate and timely publication of documentation in English on legislation, policy, and programmes;
- Ensuring full and timely disclosure to the public of preparatory materials for legislation, policy, and programmes;
- Soliciting effective public consultation through the policy-making process; and
- Clarifying functional responsibilities of provincial and district governments, and providing training to enable their acquitting their responsibilities.

■ Deepen and broaden analytical support to policy formulation by creating an energy policy unit, located within the Secretariat to the National Energy Council, within the Ministry of Energy and Mineral Resources. The key duties of this unit would be to:

- Assess, analyse, forecast, and explain national and international energy market trends, behaviours, and developments;
- Identify options for intervention by government in the energy sector and major associated sectors (*e.g.* transport, construction, and environment) by providing expert analysis of the preferred options to achieve policy and their expected outcomes and performance benchmarks;
- Develop expert analysis of barriers, opportunities, potentials, and costs/benefits of various supply and demand options, and give sufficient focus to demand-side options alongside traditional supply-side ones; and
- Monitor and report openly on the speed and the success, or otherwise, of implementing agreed energy policies and programmes.

- In co-ordination with the data units of each MEMR Directorate General, deepen and extend the capacity of PUSDATIN to acquit its centralised energy data responsibilities and, in the near future, to provide MEMR with expert energy demand forecasting, energy indicators, and long-term scenario analysis.

- Enhance MEMR data quality and transparency by:
  - Increasing financial and human resources devoted to data collection;
  - Providing mandatory authority for data collection agencies with clear penalties for non compliance; and
  - Making all public domain data publicly available in English to assist investment decision making.

III. INVESTMENT AND TRADE

OVERVIEW

Indonesia's energy sector is crucial to the Indonesian economy, for both earning export revenue and for meeting domestic energy demand. In the past, the focus has been on export revenue, but, since early this decade, there has been a rapid re-orientation by the Government of Indonesia (GOI) towards meeting Indonesia's domestic energy needs.

In recent years, a key issue for Indonesia has been the less attractive investment climate for its energy sector, which has resulted in insufficient investment to meet fast growing domestic demand and to compensate for declining production from maturing oil and gas fields. This chapter seeks to provide an overview of the general investment issues for the energy sector. Specific sub-sectoral investment issues, including regional autonomy issues, are discussed in each relevant chapter.

STATUS

Energy sector's contribution to Indonesia's economy

The energy sector remains crucial to the Indonesian economy, both in terms of its contribution to economic activity and in trade earnings. However, as the economy has matured and broadened from its resources extraction and trade focus into a stronger manufacturing and services base, the oil and gas sectors' contribution to GDP has declined. In 2000, the oil and gas sector contributed 12.4% of GDP but this has rapidly declined in both absolute terms and as a focus of the Indonesian economy. In 2007, it contributed only 7.3%. Indonesia's mining (minerals and coal) sector's contribution to GDP has grown considerably in absolute terms over the same period and contributes about 3% of total GDP.

Indonesia's energy commodities trade remains crucial to the Indonesian economy but the role of energy as an export revenue earner has declined. Factors such as the declining output of Indonesia's maturing oil and gas fields, the limited investment constraining the reserves replacement rate, and the continuing strong domestic demand for petroleum products has resulted in a reversal of Indonesia's energy export and imports trade.

Table 3.1 ..... Energy sector contribution to GDP (Year 2000 constant price, Rupiah trillion)

	2000	2001	2002	2003	2004	2005	2006	2007
*Crude oil and gas production	117	111	108	103	99	97	96	95
Mining (incl. coal)	39	45	49	51	47	52	55	58
*Petroleum refining	23	23	22	22	22	21	21	21
*LNG	32	28	30	30	29	27	27	27
Electricity	6	6.3	6.7	7.1	7.5	8	8.4	9.1
City gas	1	1.2	1.3	1.5	1.6	1.7	1.8	2.4
Total oil and gas	172	162	160	155	150	145	144	143
Total GDP	1390	1440	1505	1577	1656	1750	1847	1964
Oil and gas as % of total GDP	12.4%	11.3%	10.6%	9.8%	9.1%	8.3%	7.8%	7.3%
Mining as % of total GDP	2.8%	3.1%	3.3%	3.2%	2.8%	3.0%	3.0%	3.0%

*Sectoral contributors to total oil and gas.
Source: World Bank, 2008.

Early this decade, Indonesia's oil and gas exports earned about 23% of Indonesia's export revenue. While growing in absolute terms on the back of fast increasing international oil and gas prices, it declined to 19% of export revenue by 2007. Over the same period, coal exports grew from 3% to 6% of export revenue.

Table 3.2 ..... Energy exports contribution to trade (USD million)

	2000	2001	2002	2003	2004	2005	2006	2007
Oil and gas	14 437	12 287	12 445	13 654	15 669	19 832	21 209	22 089
Non-oil and gas fuels	n.a.	1 986	1 469	2 058	5 778	3 885	6 410	7 122
Total energy exports	n.a.	14 273	13 914	15 712	21 447	23 717	27 619	29 211
Total exports	62 620	55 518	58 079	61 104	72 674	87 086	100 799	114 101
Oil and gas as % of total exports	23.1%	22.1%	21.4%	22.3%	21.6%	22.8%	21.0%	19.4%
Non-oil and gas as % of total exports	n.a.	3.6%	2.5%	3.4%	8.0%	4.5%	6.4%	6.2%

Source: World Bank, 2008.

More tellingly, Indonesia's oil and gas imports have grown dramatically and now cost Indonesia close to the revenue generated by its oil and gas exports. Oil and gas imports increased from 17% of total imports in 2000 to 30% in 2007, on the back of strong domestic demand for petroleum products and limited investment in the domestic petroleum refinery industry.

Table 3.3 ..... Energy imports contribution to trade (USD million)

	2000	2001	2002	2003	2004	2005	2006	2007
Oil and gas	5 826	5 645	6 820	7 627	12 072	17 606	18 962	21 933
Total imports	34 286	30 109	31 940	33 154	47 303	57 968	61 065	74 473
Oil and gas % of total imports	17.0%	18.7%	21.4%	23.0%	25.5%	30.4%	31.1%	29.5%

Source: World Bank, 2008.

Indonesia imports some 35% of its finished petroleum product requirements because of the domestic refining shortfall. According to Ministry of Energy and Mineral Resources (MEMR), Indonesia needs about USD 15 billion in refinery investment over the next four years in order to reduce the country's growing reliance on finished petroleum product imports.

Investment in Indonesia's energy sector remains vital for Indonesia's economic development. Indonesia's energy resources are extensive. According to 2005 BP energy statistics, Indonesia globally ranks 25th in oil reserves and 13th in gas reserves. Reserves of coal are also very abundant when sub bituminous coal and lignite are included.

Table 3.4 ..... Fossil and renewable energy resources, 2007

Fossil energy	Resources	Reserves	Production	Reserves/Production (years)
Oil (billion barrels)	56.6	8.4	0.348	24
Gas (TCF)	334.5	165	2.790	59
Coal (billion tonnes)	90.5	18.7	0.201	93
Coal bed methane (TCF)	453	-	-	-

Renewable energy	Resources (MW)	Installed capacity (MW)
Hydro	75 670	4 200
Geothermal	27 000	964
Mini/Micro hydro	450	86
Biomass	49 810	445
Solar	4.8 kWh/m²/day	12
Wind	9 290	0.6

Source: Ministry of Energy and Mineral Resources.

The demand for electricity is high. The electrification ratio in 2005 was 54%, and the GOI aims to increase the ratio to 76% in 2015 and 93% in 2025. Independent power producer (IPP) investor funds are required, but, for much of Indonesia, with its relatively isolated islands and regions, investment in renewable energy power generation is essential to reach the target.

Indonesia's potential for energy efficiency improvement is large. To achieve a USD 1 million increase in GDP, Indonesia requires about 480 TOE of energy. Other ASEAN countries average 358 TOE (Energy Management Indonesia) and Japan requires only 92.2 TOE (Japan Energy Outlook, 2004). Investment in this field will be highly cost-effective, particularly when energy price subsidies are wound back.

Current policies and laws

The Ministry of Energy and Mineral Resources (MEMR) is very conscious of the need for private sector investment to achieve its energy development goals: the Energy

Blueprint 2005 2025 promotes private investment as one of five core strategies and it specifies measures for realising the strategy:

Energy Blueprint 2005-2025, Strategy 4: Promoting Private Investments for Energy Development, with the following measures:

- Applying both fiscal and non-fiscal economic incentives, particularly for the supply of energy for domestic needs, for the development of new and renewable energy sources and for increasing energy efficiency (Main Programmes 1, 2, 3, 4);
- Providing economic incentives to new investments to develop energy infrastructure (Main Programmes 1, 3 and 13);
- Developing energy infrastructure (Main Programme 13); and
- Developing domestic market for alternative energy sources, especially biofuel (Main Programmes 1, 3, 11, 13, 15 and 16, Supporting Programme 1).

Since the time of the Review mission, the GOI has introduced or intends to introduce several laws impacting on energy and investment.

Law No. 30/2007 on Energy

The Energy Law No. 30/2007 was under discussion in House of Representatives at the time of the Review Team's visit and was enacted in August 2007. The Energy Law is a conceptual, comprehensive and integrated law for the energy sector to achieve sustainable energy development in Indonesia. It targets:

- Securing domestic energy supply in order to improve national security;
- Achieving the optimum use of energy resources, both non-renewable and renewable energy;
- Achieving energy conservation and energy efficiency;
- Realising environment-friendly energy management;
- Utilising energy with higher added value; and
- Increasing the capability of the national energy industry.

The new Energy Law is discussed more comprehensively in the Government Structure and Process chapter.

Law No. 25/2007 on Investment

A key piece of legislation is the new Law on Investment No. 25/2007, which was enacted in April 2007. The Law on Investment is intended to address expressed investor concerns over lack of legal certainty, the difficulties of negotiating and enforcing contracts, arbitration and award judgments, and the perceived unequal treatment of domestic versus foreign companies.

Prior to the introduction of the new Investment Law, the Domestic Capital Investment Law (Law No. 6/1967, as amended by Law No. 12/1970 on Domestic Capital Investment) and the Foreign Capital Investment Law (Law No. 1/1967, as amended by Law No. 11/1970 on Foreign Capital Investment) set separate legal frameworks for Domestic Direct Investment (DDI) and Foreign Direct Investment (FDI).

Most laws in Indonesia are written in general terms, leaving many matters to be regulated by its implementing regulations. Consequently, capital investment had been regulated through various Governmental Regulations, Presidential Decrees, Ministerial Decrees, and Decrees issued from time to time by the chairman of the

Indonesian Capital Investment Coordinating Board (Badan Koordinasi Penanaman Modal - BKPM).

By way of explanation, Domestic Direct Investment is often referred to as Penanaman Modal Dalam Negeri - PMDN, which is a status for businesses that are entirely owned by Indonesian capital. Foreign Direct Investment, often referred to as Penanaman Modal Asing - PMA, is generally established as a joint venture company between foreign and Indonesian partners, but may be established as 100% foreign ownership.

The 2007 Law on Investment establishes basic investment protections including the following:

- Equal treatment for domestic and foreign investors. However, equal treatment is not applicable to investors from countries that obtain, "special rights based on an agreement with Indonesia";
- The GOI will not undertake any nationalisation action, unless by law. In the event that the GOI "takes action to nationalise," it will grant compensation based on the market value or arbitration if the two parties do not agree;
- Investors may freely transfer assets to other parties, as long as assets are not determined (by law) to be state assets;
- Investors may transfer and repatriate capital, profits, royalties, income from asset sales, and other sources, in foreign currencies, in accordance with prevailing laws and regulations. However, this does not restrict the right of the GOI to receive taxes or royalties or implement laws and regulations requiring reporting of the transfer of funds. The GOI may also implement laws to protect the rights of creditors and to avoid losses to the state; and
- Investment disputes between the GOI and investors may be settled through international arbitration based upon prior agreement between the parties.

The 2007 Investment Law requires investors to give priority to Indonesian labour. After mediation attempts and tripartite proceedings, disputes between investors and labour will ultimately be settled through the industrial courts. The Investment Law contains a new provision requiring the GOI to terminate agreements or co-operation contracts with investors following a binding court decision that they have committed a corporate crime (including a tax crime or inflating recovery cost and/or other mark-ups) resulting in a loss to the state.

The 2007 Investment Law also appears to increase the authority of Indonesia's Investment Co-ordinating Board (BKPM) in both implementing and proposing investment policy. The BKPM duties under the Investment Law include co-ordinating and implementing "one-stop" integrated services that are intended to speed up investment approval, developing an investor roadmap, and providing consultation to investors seeking capital investments, among others.

It also provides the authority for the GOI to issue a range of incentives to both domestic and foreign investors, including:

- exemptions or reductions of income tax, import duties, and value added tax;
- accelerated asset amortisation and depreciation; and
- exemptions or reductions from land and building taxes.

While the 2007 Investment Law appears to address some of the concerns of foreign investors, many of the government institutions have yet to finalise internally the micro aspects of the proposed incentives.

The Electricity Law

The GOI is drafting a new Electricity Law that will take the place of the Electricity Law No. 20/2002, which was annulled by the Constitutional Court. (This annulment will be discussed later.) Its outline is as follows:

- Priority of electricity business will be given to the state-owned limited liability electricity company, PT Perusahaan Listrik Negara - PT PLN;
- Other enterprises (*e.g.,* co-operatives, private sector, and local enterprises) will be given the opportunity to participate in the electricity business;
- Fair and healthy competition will be gradually introduced in the electricity supply business in certain areas (where technologically and economically feasible); and
- Electricity tariffs will continue to be regulated by the GOI.

The acceptability of the draft Electricity Law is as yet unclear.

The Law of Mineral and Coal Mining

The GOI is also drafting a proposed new Law of Mineral and Coal Mining. Its outline is as follows:

- Clarification of central government, provincial and district authority;
- Establishment of Mining Zone and Mining Estate;
- Establishment of "State Reserves" for special national interest;
- Mining license system: no more direct contract between the mining company and the government;
- Foreign mining company may have an agreement with the state-owned mining company or representative agency to develop a "State Reserve";
- Simplification of licensing permit for exploration and exploitation;
- Determination of mining areas through bidding;
- Community development is focused on the welfare of the local people;
- Processing and refinery production must be established in Indonesia; and
- Existing license authorities and agreements will be honoured.

The acceptability of the draft Mineral and Coal Mining Law is as yet unclear.

KEY ISSUES FOR INVESTMENT

Long-term certainty

Long-term certainty is a key factor for attracting investment, and is more important than economic incentives. Without long-term certainty, investors cannot analyse the costs and benefits of their investment. Confusion caused by the 1997-98 Asian financial crisis damaged Indonesia's investment environment, while the annulment of

the Electricity Law No. 20/2002 and parts of the new Oil and Gas Law No. 22/2001 by the Constitutional Court decreased the legitimacy of the decisions made by the GOI. Investors will continue to closely observe GOI actions.

Legal risk

A typical uncertainty for investors is legal risk. The 2004 decision of the Constitutional Court that parts of the Oil and Gas Law No. 22/2001 and the entire Electricity Law No. 20/2002 violated the Constitution is a case in point.

In September 2002, the GOI passed a new Electricity Law aimed at strengthening regulatory guidance in the power sector and promoting new investment in power projects. It planned to open certain markets for power generation for competition from 2007. However, the Constitutional Court annulled it as it considered it unconstitutional. The Court considered that electricity for production was crucially important for the country and electricity had a widespread effect on the life of the people. Based on this acknowledgment, the Court concluded that electricity should be controlled by the state and should not be subject to competition. The Court also concluded that electricity business should be conducted by a state-owned enterprise.

The Court also reviewed the Law No. 22/2001 on Oil and Gas, and ordered changes to some of the articles. It judged that the nation should operate and manage the oil business because it is an important industry, and that the nation should operate and manage the oil and gas price because it had a widespread effect on the life of the people. The Court also judged that the Oil and Gas Law's Domestic Market Obligation was to be equal to (as opposed to a maximum of) 25% of oil and gas produced.

The GOI began to review draft laws more closely subsequent to these constitutional judgements, and the GOI's efforts to enact new laws and their implementing regulations to increase certainty and provide predictability to investors are to be applauded. However, the details of proposed laws and their implementing regulations are not clear enough for the legislative impact on investment to be measured, and a more transparent and publicly accessible canvassing of draft legislation by stakeholders and the wider community is warranted.

Subsidised pricing

Subsidised or non-cost-reflective pricing for prices and tariffs both distort the decisions of investors and inject concern about stability and return on investment in a sector. Subsidised prices and tariffs weaken the motivation to improve energy efficiency and to diversify the energy mix, particularly in the case of renewable energy technologies. While current policy and laws indicate that new pricing will be cost reflective, they will not be fully implemented until after the presidential election in 2009 and their structure is unclear and not publicly discussed.

Tendering and approval process

There are concerns about the clarity of the tendering and approval process for energy sector contracts, along with the plans, programmes and budgets developed based on approved contracts.

In particular, criteria, standards, and tender format are determined by the tendering organisation itself, and are not subject to clear and transparent guidelines. For example, BP MIGAS does not necessarily disclose the new Production Sharing Contract (PSC) under the new Oil and Gas Law, nor does it always make public the terms and conditions of old PSCs even though the legal structure has been revised. This leads to confusion and opacity, deterring potential investors from tendering and provides grounds for their concern about corruption.

GOI management of investment approval co-ordination and implementation

A concern echoed throughout the Review Team discussions by both officials and industry is their need for transparency in co-ordination and clarity in responsibility and implementation. As mentioned, the new Investment Law appears to increase the authority of Indonesia's Investment Co-ordinating Board (BKPM) in both implementing and proposing investment policy. The BKPM duties under the Investment Law include co-ordinating and implementing "one-stop" integrated services that are intended to speed up investment approval, developing an investor roadmap, and providing consultation to investors seeking capital investments.

Discussions with industry suggested that GOI policy is not the sticking point; for industry, the problems lie primarily in the slow implementation of government policy and regulations due to poor co-ordination across government.

Internal government communication

MEMR's effort to improve communication among stakeholders and between government institutions is encouraging investor certainty; in particular, the progress in communication between MEMR and BP MIGAS is to be applauded. While BP MIGAS reports to the President, in reality its business is keenly related to the responsibilities of MEMR. In June 2006, MEMR and BP MIGAS agreed to communicate more closely and their mutual understanding is improving.

The communication between authorities and investors is also improving and is also to be applauded. For example, the Minister of MEMR, the Director General of Oil and Gas (MEMR), and the head of BP MIGAS are open to listening together to oil and gas contractors' concerns and have held forums to hear opinions directly.

Need for visible results

During the Review Team discussions, the Review Team heard strong frustration expressed by investors about the lack of concrete government response to their concerns. This is a troublesome finding given that government authorities have opened lines of communication to hear investors' concerns, and it indicates that improved communications have to translate into visible results as expeditiously as possible.

A useful avenue to place investor concerns before the highest level of government and to achieve expeditious results is currently the new National Energy Council. The Council's membership should ensure best representation.

Anti-corruption

Corruption remains a major issue for the GOI, and Transparency International ranked Indonesia 130th out of 163 countries in its 2006 Corruption Perceptions Index. However, the GOI is working hard against corruption and its efforts appear to be succeeding. Open equal treatment and the certainty of being able to legally seek redress improves certainty for investors. Particularly for investors from countries that have ratified the OECD Anti-Bribery Convention, the visible results in Indonesia are encouraging.

The Convention on combating bribery of foreign public officials in international business transactions, the so-called OECD Anti-Bribery Convention, was developed and subsequently approved by the OECD in 1997. It aims to prevent unfair competition through bribery of foreign public officials and to ensure the acquisition and maintenance of opportunities in the conduct of business in overseas markets. The signatories as of June 2008 are 30 OECD member countries and seven non-OECD countries, namely, Argentina, Brazil, Bulgaria, Chile, Estonia, Slovakia and South Africa.

It is worth noting that during the Review Team discussions, officials discussed a negative consequence of the anti-bribery work in Indonesia: in some instances, the drastic change to actively addressing bribery has made some public officials overly cautious in their communication and their working relationship with the private sector for fear of their actions being misconstrued. The result has been a slowing down in some officials making decisions and taking action.

Conclusions and recommendations

The energy sector is vitally important to the Indonesian economy. As a share of trade, energy represents the largest export and the second largest import by value. Its share in overall GDP is second only to the services sector. There remains a lot of potential for additional trade and investment in Indonesia's energy sector.

Indonesia is working to improve its energy sector investment climate, and recent data issued by BP MIGAS, Indonesia's upstream oil and gas regulator, advised that total investment in the oil and gas sector had risen from USD 4 billion in 2000, to USD 8.5 billion in 2005, and USD 10.1 billion in 2007. The GOI is planning to issue in mid 2008 its final series of investment Regulations, the 'Focus of Economic Programmes 2008-2009'. Key issues in the package include a review of income tax facilities for investment in certain sectors and regions, a review of a cost-recovery scheme for oil and gas producers, and public concern over transparency in the revenue and management of private energy and mining companies. However, industry retains its concern over the GOI ability to implement the policy and regulations in a timely manner.

The IEA Review Team recommends that the Government of Indonesia:

- When a new law is being considered, provide the underlying policy and detail of proposed laws and regulations to the public and stakeholders with documentation that is clear enough to enable a widespread canvassing of the impact of the proposed law.
- Provide a clear and public timetable for the removal of price and tariff subsidies. When the new National Energy Council is founded, give this issue a high priority.
- Improve tender and approval procedures by:
  - Setting clear and transparent tender selection criteria and approval standards;
  - Including relevant third-party experts in project requests for proposals and tender evaluations in order to develop investor confidence in the process; and
  - Providing for mediation procedures in the case of disputes and provide clear and unambiguous feedback to participants in tender selections.
- Choose one of two members who are to represent the industrial sector on the new National Energy Council from investors who can advise on improving the investment climate.
- Empower the Council to review impediments to investment, by periodic consultation with investors and expeditiously resolving impediments according to a transparent process and timetable.
- Continue highest-level government efforts to expose corruption in all its forms and to promote these efforts to ensure that the domestic and international investor communities recognise Indonesia as a fair and transparent country.
- Disseminate clear guidelines as to what constitutes a reasonable Government-private sector working relationship and undertake anti-bribery educational programmes for officials.
- Encourage officials in their active communication with investors while maintaining their high code of ethics.
- Regularly undertake an independent review of the country's energy sector in order to benchmark Indonesia against world best practices, assess the country's attractiveness as an investment destination, and assess the competitiveness of its energy exports.

IV. ENERGY AND ENVIRONMENT

OVERVIEW

Indonesia is the largest and widest archipelago country in the world, comprising over 17 000 islands, and 81 000 kilometres of coastline. Under the strains of rapid economic growth, urbanisation, and major industrial projects, the country suffers from a wide range of environmental problems including poor air quality in cities, pollution of rivers and seawaters, inadequate disposal of solid wastes, land degradation, deforestation, and loss of biodiversity. Indonesia's land use, land-use change and forestry (LULUCF) was estimated to account for 60% of Indonesia's total GHG emission in the Government of Indonesia's (GOI) First National Communication on Climate Change to the UNFCCC, in 1999.

Environmental impacts to which the energy sector makes a disproportionate contribution are: air quality, especially in towns; spoil and land degradation from coal mining; loss of biodiversity and forest cover; and climate change. The energy industry makes substantial use of the shoreline and coastal waters for terminals, shipping, and cooling water. While not attempting to downplay the environmental impacts of energy use and the energy industry, it is useful to quantify it in the Indonesia context; based on 1994 data, the First National Communication estimated that the energy sector contribution to GHG emission is around 25% of Indonesia's total GHG emissions. Indonesia is currently preparing the Second National Communication to update the First National Communication.

Traditional rural communities live in harmony with an environment on which they depend for food and fuel. Environmental management is enforced by custom and social pressure. With Indonesia's rapid development and influx of major projects, these traditional mechanisms are inadequate and must be replaced by political and administrative solutions based on appropriate technology and effective administration.

The two trends of decentralisation and liberalisation in Indonesia offer threats and opportunities for the management of environmental impacts. There are many advantages to be gained from the participation of local governments and communities. Many environmental impacts are local in character; they are suffered by local communities, detected first by local communities, and those communities can be involved in formulating solutions and monitoring remedies. The disadvantages may be that responsibility is passed to local administrations that are technically and organisationally ill-equipped to discharge them.

Liberalisation strengthens profit motives and this might be expected to lower environmental priorities for private companies and therefore increase environmental impacts. However, the reverse can also be true: private companies, when they are exposed to financial penalties and their policing by a regulator, are genuinely concerned about the possible loss of profits and dividends. Private companies also normally have the opportunity to pass environmental costs onto consumers and can finance remedial investments.

Conversely, state-owned enterprises seldom exhibit spontaneous preoccupation with the environmental impacts of their activities. For a state-owned enterprise, the dialogue with a regulator is a dialogue between branches of the state, and the regulator is unlikely to enter into damaging confrontation. The responsibility of a state-owned enterprise to deliver a public service may blind it to the associated environmental impacts. Also, state-owned enterprises are generally severely capital constrained and do not have the funds for remedial investment.

Indonesia is well aware of the origin and nature of the environmental impacts. The excellent 2005 "State of the Environment Report in Indonesia", available most commendably in English, demonstrates a comprehensive and deep understanding of the issues and some of the mitigation options.[3] It also reveals a chronic inability to enforce compliance with existing legislation.

Indonesia's announcement in May 2008 of its unilateral goal of an absolute cut in GHG emissions is to be applauded. The Indonesian Environment Minister advised the G8 Environment Ministers Meeting that Indonesia realises the importance of committing to a target to reduce GHG emissions; the goal is to cut energy sector emissions by 17% by 2025 and implement bold reductions in forest burning. How the cuts are to be achieved is not clear, as Indonesia also will increase emissions intensive coal in the domestic energy mix.

INSTITUTIONAL ASPECTS

Responsibility for environmental policy rests with the State Ministry of the Environment. Environmental management policy is established through the national planning process based on Law No. 25/2004 (see chapter on Government Policy, Structure and Process). From the National Long-term Development Plan 2005-2020 is developed a National Medium-term Development Plan for 2004-2009 containing the vision, mission and programmes of the President over the period.

The environment is recognised as a significant part of the overall vision of national development, which includes the intention to create a "sound foundation for sustainable development". The general goal of the Medium-term Development Plan in the environmental sector specifically is the "improvement of environmental functions

3. *The State of the Environment Report, 2005*, The State Ministry of the Environment, 2005.

and management of natural resources towards the mainstreaming of the principle of sustainable development in all development sectors and fields."

From the Medium-term Development Plan is elaborated a Strategic Plan of the State Minister of the Environment for 2005-2009 and, from that, an annual work plan. The Strategic Plan was affirmed by the Regulation of the State Minister of Environment No. 4/2005. The objectives of the Strategic Plan for this period are:

- Realising quality improvements in environmental functions, by reducing pollution loads, reducing degradation rates of natural resources, integrating environment into development planning, and increasing compliance of actors;
- Realising good governance in the sector with the objective of "mainstreaming" or integrating environmental policy and consideration into regular policy and management of natural resources and environment at all levels of government; and
- Increasing the capacity of the State Ministry of the Environment.

Funding

Funding for environmental management comes from several sources. The State Revenue and Expenditure Budget includes a general environmental budget; this is a development budget drawn upon by several ministries and other government institutions. In 2005, it amounted to Rp 3.1 trillion, of which about Rp 2.2 trillion was for the conservation of natural resources. The share of the Ministry of Environment was Rp 179 billion. Review discussions did not highlight any environmental taxes or fees that contribute to the national budget.

The Ministry also draws upon the Routine Budget from which, in 2005, it received Rp 29 billion. Together with foreign loans and foreign grants, the Ministry received a total of Rp 273 billion (USD 30 million) for its programmes. It is instructive to compare this sum to the allocation for kerosene subsidies of Rp 43 trillion and the electricity subsidy of Rp 21 trillion. The Ministry also receives money from a Special Allocation Fund in the Environmental Sector designed to support local government, especially in the monitoring and improvement of surface waters.

Legislation and institutions

There has been considerable effort expended in developing legislation and institutions for environmental management, and in developing the necessary scientific and administrative support to make them effective. The first environmental legislation in Indonesia was Law No. 4/1982 regarding the Basic Provisions for the Management of Living Environment. This was extended by Law No. 23/1997 regarding Environmental Management that sets out the rights of citizens and the compliance obligations of business.

In outlining the Ministry of the Environment and these two laws, it should also be recognised that there are many other regulations and institutions that are involved

in regulating specific environmental problems and issues in Indonesia. These are discussed in later sections of this chapter.

The Law No. 4/1982 establishes the requirement for an environmental impact analysis and licence for activities that give rise to "a large and important impact". The law establishes the duties of the state and its representatives including some rights of entry, permits delegation of functions to local government, and establishes procedures for legal action, compensation and dispute resolution. There is, however, little provision for penalties to be imposed by the Ministry for non compliance.

The Law has been elaborated by implementing regulations including Regulation No. 29/1986 concerning Environmental Impact Assessment (EIA) and Regulation No. 41/1999 concerning Air Pollution Control. However, environmental impacts remain serious. Air quality in Jakarta and other cities is bad and deteriorating; uncontrolled land-clearance leads to loss of forest cover and erosion; mining has damaged forest and river resources; and there is no policy to help mitigate climate change and no recent inventory of carbon emissions. A 2002 Asian Development Bank-funded study estimated that the economic losses related to poor air quality in Jakarta would increase from USD 181 million in 1989 to USD 403 million in 2015 in the absence of countermeasures.[4] Such costs are difficult to measure, but experience in similar countries suggests that environmental damage constitutes several percent of total GDP. To reduce this economic damage justifies a substantial effort.

As noted, Regulation No. 29/1986 concerning Environmental Impact Assessment defines procedures for an environmental impact assessment (Analisa Mengenai Dampak Lingkungan (AMDAL) in Bahasa). The initiator of a project is obliged to submit its proposal to an Environmental Impact Assessment Evaluation Commission that examines the environmental implications and decides whether undertaking an environmental impact assessment (EIA) is necessary. If an EIA is recommended, Terms of Reference are drafted by the initiator and submitted to the Commission for approval. After completion of the evaluation, the environmental assessment reports are submitted again to the Commission and, if approved, an operating licence is issued. Environmental management and monitoring recommendations (RKL and RPL) are submitted with the EIA. The procedure may take a year to eighteen months.

Following the earthquake and tsunami disaster in 2004, the Ministry of the Environment issued Decree No. 308/2005 regarding Special EIA for Reconstruction and Rehabilitation activities in NAD and Nias (Aceh and the island of Nias). This Decree was introduced because it was recognised that the reconstruction required quicker planning without minimising the quality of the EIA itself and it established shorter bureaucratic procedures. The new approach will be evaluated and, if found successful, may be implemented as a general national system.

Anecdotal evidence suggests that Indonesia's procedures for an EIA are sufficiently stringent and consistent with international standards. However, poor implementation

4. *Tomorrow's Crises Today: The Humanitarian Impact of Urbanisation,* UN Office for the Co-ordination of Humanitarian Affairs, September 2007.

in many cases limits their effectiveness in influencing project planning, design, and implementation. Anecdotal evidence suggests also that approvals for development may be granted without the necessary documentation in exchange for illegal payments.

Critics perceive most of the EIA reports as containing much irrelevant information and failing to focus on key aspects. EIA findings and recommendations are often not adequately taken into account in the decision to approve operating licences and there is little follow-up on the implementation of the environmental management and monitoring recommendations.

Enforcement of environmental law across Indonesia is generally weak. The existing legislation does not give adequate powers to the Ministry of the Environment and its agents. Clearer and stronger rights of entry and access are necessary, and provision should be made for direct penalties for non-compliance with performance standards and environmental direction. There is some discussion of these issues in Law No. 23/1997 on Environmental Management, but interpretations vary. Together with the appropriate Commission of Parliament, the current legislation is being revised by the Ministry of the Environment to strengthen these powers. We welcome this development.

There is an elaborate and cumbersome complaints procedure that seems to be little used. Part of the problem is that procedures for fines are not well developed. Legislation provides for such remedies, but at present, penalties can only be decided through the courts. There is an intention to change this and to introduce direct fines and this should be done. Fines need to be set at a level that successfully deters non-compliance and they need to be rigorously applied to all offending parties.

Institutional capacity

The Ministry has good technical skills and is committed to its task. However, it comprises about 600 staff in Jakarta and 400 in the regions, and this is insufficient to monitor and control environmental impacts over the immense land and sea resource of Indonesia, particularly given the seriousness and complexity of some of the issues. More trained staff are needed, and this is especially acute in the regions and municipalities that have recently inherited responsibilities for implementation.

Capacity of provincial and district governments will be strengthened through a Special Allocation Fund in the annual budget, but this needs to be complemented by training, including training in local community participation. Still larger budgets will be necessary at provincial and district levels, and it is reasonable that a part of this should be paid by provincial and district governments who now receive a part of the royalties from primary energy production.

Mainstreaming the environment

The Ministry of the Environment does not appear to play a significant role in energy policy formulation at the outset. The incorporation of full environmental objectives

(including GHG emissions policy) in the initial concept of policy for the energy and transport sectors is required. This "mainstreaming" of environmental policies should be the principal objective of the Ministry of the Environment, and it can only be achieved through a co-operative process among the responsible ministries.

Mainstreaming is helped by environmental policy analysis that quantifies and assesses environmental impacts and their intervention instruments in a similar accounting methodology to financial impacts. This capacity also strengthens the position of the Ministry of the Environment because it supports transparent decision making. It would be helpful to create a dedicated policy analysis unit within the Ministry for the Environment with the function of analysing and influencing the policy of line ministries at the outset of policy deliberation rather than cleaning up afterwards during implementation.

AIR QUALITY

Air pollution is a major problem in most cities in Indonesia and especially in Jakarta. There is a tendency for all the major pollutants to exceed safe levels, but, in most cases, it is airborne particulates that pose the main burden and cause the biggest damage to public health. The main contributors to airborne particulates are motor vehicles, rubbish burning and industry.

Natural sources of air pollution include volcanic eruptions but particulates from forest fires lit by farmers to clear forest for palm oil and other plantation crops is, by far, the worst offender. This is a major concern not only to Indonesia, but to other ASEAN countries, particularly Malaysia, Brunei Darussalam, and Singapore. Damage from this activity to air traffic and business throughout the region has been estimated at several billion dollars.

Monitoring air quality

Regulation No. 41/1999 regarding Air Pollution Controls assigns responsibility for monitoring air quality to the government. The local government of Jakarta made irregular measurement of air pollution starting in 1985. Continuous monitoring of air pollution began in 1990 at six monitoring sites in Jakarta using equipment supplied by the Government of Japan. However, the equipment was not properly maintained and none is now working.

From 1999 to 2002, the Jakarta Office of Environment (BAPEDALDA DKI Jakarta) built 33 continuous monitoring stations for air quality in 10 large cities with the assistance of the Government of Austria. The stations monitored concentrations of CO, PM10 (particulate matter of 10 micrometers or less), SO_2 and NO_2 and O_3. Data were exposed on bill boards and published in the media. Unfortunately, the local

governments concerned did not allocate adequate funds for maintenance and now much of the equipment does not function.

Monitoring in the two cities where equipment is still in fairly continuous operation reveals a chronic problem across the country: air quality is good in Jakarta only 29 days out of the year and in Semarang 229 days of the year. In most other cities, there are too few days monitored to give reliable frequencies. That data which exists shows seriously poor air quality.

Vehicle emissions and controls

The annual growth of Indonesia's vehicle stock is around 12% while road development grows at around 5%. The inevitable consequence of this disparity is spectacular road traffic congestion. For example, on weekends on the road from Jakarta to popular resorts in the south, traffic may be brought to a virtual halt for several hours. This greatly reduces fuel efficiency of vehicles and leads to high emissions and high roadside levels of pollutants. The poor condition of public transport and its limited services encourages people to buy and use private cars. Increasing distances from home to office and school also contribute to the increased volume of traffic. There has been a small improvement in public transport in Jakarta recently, with the establishment of a few key bus lanes on critical routes and fast buses of better standard. Efforts to improve public transit should be redoubled, with emphasis on fully developing the TransJakarta Bus Rapid Transit (BRT) system.

Many of the vehicles registered in Jakarta are motorcycles, of which the majority have two-stroke engines. They produce disproportionate amounts of suspended particulate matter and hydrocarbon emissions. Motorcycles and Indonesia's three-wheeled passenger-carrying motorcycles (called bejaks or tuk tuks) are popular because they are affordable and manoeuvrable in the congested traffic. They are used for personal transport and are the most common form of commercial transport.

Standards for emissions from motor vehicles are set down in the Minister of Environment Decree No. 35/1993 on Threshold Limit of Waste Gas Emissions on Vehicles. Spot checks by the Ministry of Environment in Jakarta, Bandung, Banjarmasin, Semarang and Medan showed that most vehicles failed this standard. There are no penalties for breaching the Decree.

Jakarta has carried out several efforts to improve the air quality. The Clean Air Programme (Programme Udara Bersih - PRODASIH) is a recent initiative that includes an inspection and maintenance programme, industrial emission control, traffic management, managing land use development, promoting the use of clean fuel gasoline, and expanding the urban green spaces.[5] A study by the Japan International Co-operation Agency (JICA) and the Indonesia Environmental Impact Management

5. *Jakarta Air Quality Management: Trends and Policies*, Kosasih Wirahadikusumah, Head of Jakarta Environmental Management Agency, Jakarta Metropolitan Government, The Regional Workshop on Better Air Quality In Asian and Pacific Rim Cities, Hong Kong, 2002.

Agency (BAPEDAL) in 1997 showed that more than 50% of CO emissions came from cars and about 20% from motorcycles. Together these groups contributed about 40% of the hydrocarbon emissions. More than 50% of NO_x was emitted by cars and around 30% from buses. Cars, buses and trucks are equally responsible for SO_x and PM-10 emissions.

In 1997, the local government of Jakarta introduced the Inspection and Maintenance Programme (I&M) under the Gubernatorial Decree No. 95/2000. The implementation of I&M is delegated to private enterprise vehicle testing workshops, and, to ensure a high standard of services delivered, the operators and the vehicle testing workshops are monitored. All private cars registered in DKI Jakarta are required to meet I&M regulation each year; they can choose the vehicle testing workshop to provide the I&M and the cost of the service is determined by market forces. The results are stored with the vehicle/owner data on a database and transferred to an I&M Centre where the data is accessible to the public to guarantee transparency.

The concept of the programme can scarcely be faulted, but it appears that there is little or no implementation. At least one vehicle testing workshop exists with computerized testing facilities that can process up to 188 vehicles a day. However, owners of public vehicles, including local authorities, simply do not comply with the legislation. Private car owners not only do not comply but do not appear to be aware of the obligation. Consequently, the impact of the programme seems to have been minimal.

The Decree of the Minister of the Environment No. 141/2003 regarding New Type and Current Production Motor Vehicle Exhaust Emission Standards requires the Ministry of the Environment to approve the emission test reports of new vehicle designs before the Directorate General of Land Transportation can authorise sales. In 2005, the necessary documents were submitted for only two new models of car and twelve models of motorcycles. This is a small proportion of models entering the market, and there is a need for co-operation with the Ministry of Transportation to be strengthened.

Fuel standards

The ASEAN has adopted the EURO 2 standard as a minimum fuels specification standard for vehicles and most governments in the region have moved on to more stringent EURO standards. In March 2006, the Ministry of Energy and Mineral Resources (MEMR) issued the Decrees of Directorate General of Oil and Gas Nos. 3674 and 3675/24/DJM/2006 regarding Standard and Quality (Specification) of Oil Fuel of the Type of Gasoline (and of Diesel) which is Marketed Domestically. It is on this basis that Shell and PETRONAS, recent entrants to Indonesia's petroleum retail market, are selling high specification vehicle fuels in Indonesia. However, most vehicle fuel in Indonesia does not meet this standard and does not meet EURO 2 standards.

Indonesia has banned the use of lead in gasoline. Unleaded petrol of international specification is available and this enables the import of new cars with exhaust catalytic converters.

The State Ministry of the Environment carries out regular surveys of gasoline and diesel quality, including sulphur levels. These surveys reveal that sulphur content of diesel in Indonesia varies across the country and appears to be deteriorating. Sulphur is a direct hazard to health and is an important contributor to particulate emissions.

The permitted level of sulphur is 3 500 ppm, although it seems that products below this standard are occasionally sold: some areas like Jakarta, Palembang and Batam are supplied with fuel with a sulphur content of 1 000 ppm. This remains very high compared to prevailing international standards which are generally 50 ppm and less. 10 ppm is critical for allowing the introduction of advanced emissions control systems (like particulate filters) on diesel vehicles.

Sulphur concentrations in middle distillates can be reduced by blending with low sulphur products, or by hydro treatment of gas oil streams in the refinery, or by catalytic cracking of fuel oil. The simplest option is to import low sulphur distillate. A study in Pakistan[6] concluded that the cost of reducing Pakistani diesel sulphur content from 1.0% (10 000 ppm) to 0.5% (5 000 ppm) in this manner would be USD 0.003/litre. Hydro treatment is the most straightforward approach within the refinery, while the cracking of fuel oil is a major undertaking which would not be performed solely to reduce the sulphur content of middle distillates. At present, sulphur reduction is not an attractive option for the Indonesian refinery sector, because until recently there was no technical requirement in the market for low sulphur products. Even now there is only a premium in a small market segment. The internal rate of return does not pass investment hurdle rates, so raising finance via commercial channels (including international investment) is not possible. Assigning sulphur abatement a value and internalising the damage costs through a national standard would change this picture.

Part of the rationale for the development of Indonesia's biofuels programme is to lower sulphur emissions in transport by using biodiesel. A specification for biodiesel is needed to ensure consumer confidence for its use. The National Standardisation Board has affirmed the standard for biodiesel and the Directorate General of Electricity and Energy Utilisation will co-ordinate with the Directorate General of Oil and Gas to implement the standard through regulation.

While the older gasoline fuelled vehicle fleet in Indonesia uses an octane of 88 RON (*i.e.,* subsidised gasoline known as Premium gasoline), newer vehicles generally require an octane of at least 91-92 RON to operate optimally. Most of the supply has a largely sufficient octane number to meet the requirements of both vehicle fleets. Sampling by the Ministry of the Environment in 2005 revealed only occasional drops below 88 RON.

Industry emissions and controls

To control air pollution from fixed sources, the Ministry of the Environment issued Decree No. 13/1995 regarding the Emission Quality Standard for Fixed Sources.

6. *Pakistan Clean Fuels*, October 2001, ESMAP Report No. ESM246/01.

This deals with air emission standards for iron and steel, cement, pulp and paper, steam power plant, and similar large industries. Operators are obliged to provide their facilities with emission controls and the means to measure exhaust gas emissions including sampling holes and platforms. They must also conduct emission tests on chimneys periodically and make regular emission measurements. The results are to be reported to the local government with a copy to the Ministry of the Environment. Some improvements have certainly been made to the performance of some plant, but there seems to be no consolidated review of impact.

Farmers in Indonesia burn forest annually to clear land for agriculture. The GOI has forbidden the practice, but weak enforcement means that the ban is largely ignored.[7] The practice is also often adopted to clear land for planting timber and for plantations dedicated to palm oil production and export; Indonesia is the leading exporter of palm oil. The pollution from the burning of forests seriously affects neighbouring ASEAN countries, and, during the worst episodes in 1997-1998, the costs across the region were estimated at USD 9 billion arising from disruptions to air travel and other business.[8] The Ministry of the Environment has responded to the problem by requesting governments of affected regions to anticipate and control events. The problem has been addressed also at the ASEAN level and Indonesia has ratified the draft ASEAN Agreement on Transboundary Haze Pollution.

COAL MINING

Indonesia's mining sector comprises large and medium-scale mines and many artisanal and small scale mines. The main products are gold, silver, copper, nickel, tin, and coal. Less than 0.25% of Indonesian territory is dedicated to medium and large-scale mining. Much of the land where mining takes place has little agricultural value, although loss of biodiversity is a major concern.

Environmental practice in the mining sector has improved over the years. Mining was originally focused on economic growth with little environmental regulation. In the mid 1970s, the Ministry of Mines and Energy (predecessor of the MEMR) began to regulate environmental performance. This was strengthened by the Environmental Management Act of 1982 and the EIA procedures, and the Ministry of Mines and Energy updated the regulation for prevention and mitigation of environmental damage and pollution in 1995. The Decree of the Minister of Mines and Energy in 1995 introduced an obligation to restore land and vegetation damaged by mining. It established a Reclamation Guarantee Programme requiring retroactively that large producers post a guarantee of timely and proper reclamation of mining areas. Mining companies are required to plan reclamation before the conclusion of operation and to provide funds for government to implement the plan if the company does not.

7. Jakarta Post, *RI fires affect Malaysian air quality*, July 3, 2007.
8. Jakarta Post, *ibid*.

The decentralization to regional autonomy in 1999 retains the ownership of mineral rights in the state, but transfers the responsibility to issue permits and to oversee mining activities from MEMR to provincial and district governments. Royalties from coal production are also now paid to the provincial and district governments via the central government, and the function of environmental monitoring was largely transferred to local authorities. However, the Ministry of the Environment and the provincial and district governments each have mandates for environmental management of mining, and residual responsibilities also remain with the MEMR. The split of responsibilities and tasks among these various agencies has generally been specified in the MEMR Governmental Regulation No. 75/2001, on General Mining Activities which is intended to provide interim guidance until Parliament passes a new mining law to replace Mining Law No. 11/1967. It is hoped that the new Law on Mining of Minerals and Coal, long in preparation, will clarify these matters.

Environmental performance

A World Bank study in 2000[9] determined that environmental practices in large-scale mining in Indonesia were reasonably good. Applying international best practices as a guide, the study estimated that the approximate environmental budget for large scale coal mining should average USD 10 million per year, which is much less than 1% of the gross revenues of the major four coal mines in 1998.

There are a few good examples of mine reclamation such as that practiced by Kaltim Prima Coal, a large-scale mine located in East Kalimantan. Kaltim Prima has a successful programme of permanent and temporary land rehabilitation including land preparation, nurseries, planting, and field maintenance. Temporary rehabilitation is undertaken to prevent soil erosion and involves stabilising areas and overburden dumps that will be disturbed again. The mine moves, stores, and stabilises more than 40 million tons of overburden per year, so failure to temporarily rehabilitate the overburden dumps could cause an environmental catastrophe. Kaltim Prima temporarily rehabilitates and stabilises over 300 hectares per year. Permanent rehabilitation takes place on land that will not be disturbed again. It is covered with top soil and planted with mostly native species of plants and trees. Usually, there is a first line planting to stabilise the soil followed by a final planting. Kaltim Prima permanently rehabilitates over 200 hectares of land per year.

The environmental performance of the medium-scale coal mines was generally poor. Problems included water pollution from coal preparation plants, inadequate sediment ponds, no recovery of coal fines, no back-filling of open-pit mines, and poor management of overburden topsoil, which means that it is not available later for mine reclamation.

The study by the World Bank estimated an upper bound for the cost of preventive measures for the medium-scale coal industry at USD 0.23 per ton of coal. From

9. *Mining and the Environment in Indonesia: Long-Term Trends and Repercussions of the Asian Economic Crisis*, East Asia Environment and Social Development Unit, World Bank, 2000.

this it deduced that medium-scale coal industry of Indonesia could achieve strong environmental performance (including reclamation) with an expenditure of about USD 3 million per year. Relative to the value of coal output for the medium-scale coal industry at the time, this was significantly less than 1% of gross revenue. Moreover, a significant part of this cost could be recouped by the recovery of coal fines.

The worst environmental damage is caused by small-scale illegal mines. These have proliferated since the Asian financial crisis and the rise in international coal prices. The location of many illegal mines is generally known, but they survive because of the support of powerful interests and a lack of law enforcement.

Many companies do not fulfil their obligations for rehabilitation: the State of the Environment Report for 2005 estimates that 56% of the ex-mining area in East Kalimantan has not been restored. The criteria for land rehabilitation are not well defined in the legislation, and, as a result, it is hard to evaluate the compliance of companies.

The inadequate compliance is compounded by the limited resourcing of the responsible authorities and their enforcement of the legislation. For example, the World Bank study in 2000 determined that the budget of the environmental unit within the Directorate General of Minerals, Coal and Geothermal of the MEMR was sufficient for only 20% of its responsibilities. Much larger budget allocations would be justified now. In principle, the local governments who now receive the royalties should have a close understanding of the local problems, be sensitive to the environmental concerns of their electorate, and be in a position to enforce the legislation. However, this is not the case as yet.

CLIMATE CHANGE

Indonesia signed the United Nations Framework Convention on Climate Change (UNFCCC) on 5 June 1992. On 1 August 1994, the President of the Republic of Indonesia approved the Act of Ratification of UNFCCC No. 6/1994. On August 23, 1994, the document was submitted to the Secretary General of the U.N. Indonesia is legally included as a Party of the Conference and one of its obligations is to communicate actions taken to mitigate climate change. In order to properly address climate change issues and to discharge these functions, the State Ministry of the Environment established the National Committee on Climate Change. Members of the Committee include representative from sectoral ministries related to environment.

Greenhouse gas emissions

Indonesia made its first National Submission[10] to the UNFCCC in 1999 and this submission includes an inventory of the most significant greenhouse gases (GHGs) for 1994. GHGs included in the inventory are CO_2, CH_4, N_2O, NO_x, and CO. In

10. *First National Communication on the Climate Change Convention,* State Ministry of the Environment, 1999.

developing the inventory, the 1996 IPCC Methodology was used and most sectors considered by IPCC are covered in the inventory. The accuracy of estimating the emission and removal of GHGs from the atmosphere largely depends on the availability and quality of Indonesia's data and emission factors. Forestry is the sector in Indonesia with highest uncertainty. In early reports, it was concluded that Indonesian forests were a net sink. However, with improvement of activity data as well as emission factors, it became clear that under present circumstances Indonesian forests are a net emitter.

This issue has become extremely controversial. Indonesia has 22 million hectares of tropical peat swamps formed when trees and vegetable debris rot. These areas contain large volumes of GHGs that are released when the forest is cleared for timber and oil palm plantations. Press reports put Indonesia as number four or possibly three on the list of global contributors to GHG emissions mainly because of emissions relating to land use. The GOI intends to update the inventory on the forest sector and to prepare a programme to reduce GHG emissions from land degradation and deforestation. This is urgently needed; it is a priority for many donors and the GOI should proactively seek donor support for this endeavour.

Clean Development Mechanism

In order to meet the requirements of the Clean Development Mechanism (CDM) in line with the Kyoto Protocol, the Ministry of the Environment has established a Committee on the Clean Development Mechanism through the Ministerial Decree No. 206/2005. The Committee has responsibility to grant CDM project proposals, track the documents in the CDM Executive Board, monitor and evaluate the performance of the CDM projects, and submit an annual report to the UNFCCC. The Committee includes representatives from the concerned ministries including Energy, Forestry, Industry, Transportation, and BAPPENAS.

By the end of 2005, five CDM projects had been approved by the Committee. They were: two projects from Indocement to employ alternative fuels; palm oil kernel power plants in North Sumatra and Riau, and the promotion of the use of solar cookers in Aceh. There are many other proposals from the energy sector that are in preparation including a geothermal power plant Darajat III, the management of pig waste on the island of Batan, biomass fuelled power plant in several locations, and the management of urban wastes in several cities. Bilateral Memoranda of Understanding have been signed with the Governments of Austria, Canada, Denmark and Netherlands.

Conclusions and recommendations

Indonesia is well aware of the origin and nature of the environmental impacts wrought by its energy consumption and energy industries. For many years, the GOI has spent considerable effort in developing legislation and institutions for environmental management, and in developing the scientific and administrative support to make them effective. The chronic inability to enforce the compliance of energy consumers

and energy industries with existing legislation is the underlying issue that needs to be addressed.

The IEA Review Team recommends that the Government of Indonesia:

- Strengthen powers of inspection and penalties in legislation to improve compliance and enforcement.
- Strengthen the implementation capacity of local administrations, including for monitoring, enforcement, and impact assessment, through training and enhanced budgets.
- Mainstream the environment in energy policy formulation, and create an Environmental Policy Analysis Unit within the Ministry of the Environment to work with other line Ministries to ensure that their policies reflect the environmental objectives of the GOI in a cost-effective manner.
- Institute funding and reconstruct a comprehensive monitoring system of emissions and ambient air quality.
- Institute funding and comprehensive policing of rigorous and widespread vehicle testing and industry emissions to ensure the progressive introduction and enforcement of EURO-like air quality standards in parallel with tighter fuel specifications.
- Design, fund and launch strong environmental interventions in critical areas of the mining sector including:
  - improved management of the impacts of medium and large-scale mining projects by strengthening and clarifying the requirements of EIAs and ensuring strict monitoring and enforcement of implementation; and
  - control illegal mining by co-ordinated action with local authorities and local action groups.
- Update Indonesia's national carbon inventory and in particular provide a fuller description of the forest sector based on the most recent science.
- Develop the Second National Communication that would outline policies and measures to address emissions from fuel combustion and deforestation.

V. ENERGY EFFICIENCY AND CONSERVATION

OVERVIEW

The Government of Indonesia's (GOI) desire to advance its economic growth and social development while meeting its 7% per year energy demand growth creates a compelling need to 'look at the demand side' and to advance energy efficiency and conservation (EE&C) in Indonesia.

Current regulations, policies and programmes

The laws and regulations governing EE&C in Indonesia are:

- Presidential Instruction No. 10/2005 on the Instruction on Central and Regional Government to implement EE&C: implementing energy efficiency in government offices (lighting, AC, electricity equipment, official vehicles) and buildings;
- Ministerial Regulation No. 31/2005 on the Procedure for EE&C Implementation: regulating energy efficiency measures in government offices, households, commercial buildings, industries, transportation and other activities; and
- Energy Law No. 30/2007, Article 25, concerning Energy Conservation, stipulates that EE&C is the responsibility of all energy users and that incentives will be offered to efficient users and to producers of efficient appliances. Implementing regulations are to be drafted.

Indonesia's 2003-2020 National Energy Policy includes an action plan targeting EE&C. The operational elements are familiar to EE&C policy for other nations, and include:

- increasing use of energy saving equipment and appliance standards and labelling in households and commercial sectors;
- promoting cogeneration and applying demand side management (DSM) in industry; and
- applying energy efficiency standards on motor vehicles.

The plan carries an economy-wide target of a 1% per year reduction in energy intensity. However, this is unlikely to be met due to the need for improved energy delivery throughout the economy and the limited scale of Indonesia's EE&C efforts. It will also be very difficult to meet while Indonesia's energy pricing includes subsidies that 'reward' energy inefficient technologies and practices.

Table 5.1 ..... Key energy efficiency and conservation players

Player	Function	Accountabilities	Status and opportunities for developing EE&C
Parliament and the President	Highest level leadership and vision	Representing the people of Indonesia in ensuring an effective focus on sustainable energy	Current laws and Presidential decrees show a willingness to put in place the essential leadership directions
BAKOREN	High-level co-ordination	Ensuring ministries co-operate around EE&C priorities	Ensure various ministries are aligning efforts around EE&C policies and directions
BAPPENAS	Long-term macroeconomic planning	Ensuring EE&C effectively factored in long-term plans	Ensure EE&C options are evaluated alongside other options and included in strategic planning
Co-ordinating Ministry for Economic Affairs	Energy policy, strategy and co-ordination	Ensuring ministries develop integrated policies for EE&C priorities	Need to ensure other ministries understand value to their respective portfolios from EE&C policies and support EE&C policy
Ministry of Energy and Mineral Resources (MEMR)	Energy policy, strategy and co-ordination	Lead and balance EE&C policy within energy policy context	Ensure EE&C policy focus and the co-ordination and clarification of accountabilities and strategies for EE&C
Directorate General of Electricity and Energy Utilisation, MEMR	Electricity and energy utilisation policy, strategy and co-ordination	Managing EE&C policy and programmes	Improve co-ordination and manage accountabilities across EE&C operational activities
Directorate General of Oil and Gas, MEMR	Oil and gas policy strategy and co-ordination	Ensure policies support EE&C policy	Ensure oil and gas processing is efficient
Agency for Education and Training, MEMR	Training and capacity building	Capacity building and training for energy sector	Industry respected capability builder. Needs better integration with other EE&C developers and improved resources to deliver its capacity building
Ministry of Industry	Industry energy efficiency policy and co-ordination	Lead EE&C implementation within industrial sector	Opportunity for adoption of appliance and industry standards for domestic and export-orientated industries
Ministry of Public Works	Public works energy efficiency policy and co-ordination	Lead EE&C implementation within public works sector	Opportunity for adoption of building standards
Ministry of Transportation	Transport energy efficiency policy and co-ordination	Lead EE&C implementation within transportation sector	Opportunity for adoption and enforcement of vehicle fuel efficiency standards
Ministry of the Environment	Environmental policy	Sets and monitors environmental standards	Should explore fully its ability to use EE&C as a means to mitigate environmental problems and support EE&C policy
BPPT	Assessment and capacity building in EE&C technologies	Modelling, analysis, R&D and capacity building in EE&C technologies	Sound analytical and R&D capability. Strategy and resources needed for integrating BPPT skills with broader EE&C policy and operations
PT PLN	Generator, distributor, retailer	Shapes consumer response with tariffs	Must pursue existing progressive tariffs and demand tariffs aggressively. Use PSO to develop EE&C opportunities
PT Energy Management Indonesia	EE&C agency	EE&C operational development	Sound operational skills and operations. Strategy needed to develop its role and capability

The Energy Blueprint 2005-2025 builds on the National Energy Plan's objectives, primarily in Main Programme 5: "Application of demand side management". Together, the Plan and Blueprint provide the platform for Indonesia's future EE&C efforts. Achieving the objectives of the Plan and Blueprint is a significant undertaking and will require a long-term strategic approach. Central to this will be providing the authority, the resources and the focus for the key EE&C players in Indonesia, and undertaking a regular and transparent review of EE&C programme implementation.

Key players and the institutional setting

There are multiple players in and around the EE&C institutional space. Most are effectively undertaking their individual roles, and have well-skilled staff and experience in their fields. However, it is not clear what roles they play in delivering the Plan and Blueprint, how their accountabilities are integrated, or how resource allocations are made.

The range of skills required for implementing an Indonesia wide EE&C policy is available in existing institutions, such as PT Energy Management Indonesia, PT PLN, BPPT, the Education and Training Agency of MEMR, the Directorates of MEMR, and many potential private sector players. But capacity development of these institutions is required if they are to deliver EE&C services to meet the economy wide target of a 1% per year reduction in energy intensity.

Currently, energy elasticity of demand is about 1.8; in other words, Indonesia's energy demand (averaging 7% per year growth) is growing faster than the population (1.5% per year) and GDP (5-6% per year). In aggregate, Indonesia's energy intensity appears high. This, however, is deceptive as Indonesia has a structural activity mix that ranges from very low household energy intensity to some industry with high energy intensity. Indonesia is also undergoing structural change with the growth in its less energy intensive "services sector".

In targeting EE&C policy and programmes, it is important to understand the range of energy intensities across the different sectors in Indonesia. The low wealth and low energy consumption of Indonesian households means that they unlikely to have much scope for conservation – you simply cannot conserve what you are not already consuming.

KEY ISSUES AND CROSS-SECTORAL CHALLENGES

There are a number of key issues that limit Indonesia's ability to develop and implement cost-effective EE&C programmes.

Cost-reflective pricing

Market-based pricing that reflects the extraction, distribution and externality costs of a fuel are necessary for a sustainable EE&C programme. Review Team discussions with MEMR officials highlighted their frustrated attempts over many years to implement EE&C programmes knowing they would require continued government support while price subsidies remain in place.

Ideally Indonesia will move to cost-reflective pricing for energy services. Innovative tariff options such as progressive pricing offer an effective way to move to cost reflective pricing while still meeting the needs of low income consumers. Commercial and industrial users should pay a capacity price as well as a unit consumption price in order to reflect the full cost of their energy demand. New tariffs can be integrated with energy efficiency technology incentives.

Energy end-use data and energy indicators

Given their low income and low energy consumption, most Indonesian householders are generally likely to have little scope for energy conservation. New electrical connections are staged at 450 VA, 900 VA and 1 450 VA, and high household electricity intensity is unlikely with these capacity limits. This is also likely for many industry sectors in Indonesia that appear to be locked into a pattern of inefficient plant producing low value added products with poor access to capital to improve.

Consequently, it will be critical at the outset for MEMR to accurately target its EE&C programmes at the correct consumer sectors in the most cost-effective manner. An energy indicators database using detailed energy end-use data and economic data at the sub-sectoral and technology level is necessary. The Government Policy, Structure and Process chapter discussed the need to enhance the capacity of PUSDATIN to build accurate and comprehensive energy efficiency indicators and to develop their policy implications. MEMR data will also necessarily include the characteristics of energy end-use technologies and appliances and the manner in which consumers and industry select and use technologies.

Determining longer term energy efficient technology options

An EE&C strategy logically includes a longer term strategy for the introduction of least cost energy efficient technologies into the market place. Agencies with the expertise and activity to analyse longer term technology options for Indonesia include BPPT and its MARKAL modelling team. This team has many years experience including analysis underpinning the National Energy Plan and informing government policy and decision making. Strengthening of Indonesia's technology options analysis should draw on international experience in the modelling of energy efficient technologies and their introduction into the market.

Integrating the EE&C players

As identified, there are many players in EE&C in Indonesia, and a major challenge is to ensure that these players work to their respective strengths in an integrated manner towards delivery of the national objectives for EE&C. To do this requires a clear strategy incorporating the role of each player, resource requirements, milestones and accountability, and monitoring and review processes.

In the Government Structure and Process chapter, the case is made for the establishment of a Directorate General of Energy Efficiency, Conservation and Renewable Energy. From the EE&C perspective, the rationale for this is based on the need to ensure the highest level focus on the demand side that has the authority to garner resources and to plan and monitor implementation.

Capacity building

Across the GOI and private sector, there are a range of sound skills that should be more widely applied and better resourced. The Agency for Education and Training (AET) of MEMR plays a key role in developing Indonesia's energy sector capabilities. It has an established skill in training, a sound relationship with industry, a consultative approach with its stakeholders, and a credible performance. It is contracted by industry to undertake training. A key challenge is that AET seems to be operating its EE&C training at a below critical mass due to funding constraints. So far, most of its EE&C training programmes have been conducted for government officers.

Other agencies involved in EE&C capacity building include PT Energy Management Indonesia, the BPPT Energy Technology Centre, the University of Indonesia and the Ministry of Industry. The BPPT Energy Technology Centre emphasises practical R&D and technical training in energy conversion and utilisation technology for RE technology, EE&C technology and fossil fuel technology.

WHAT IS POSSIBLE?

Supply side efficiency

The state-owned electricity company, PT PLN, is in an untenable situation – it is required to sell electricity at subsidized rates but face increasing generation costs, already 50% greater than retail prices. Demand continues to grow and PT PLN must work toward the government's goal of increasing electrification.

Consequently, where it is cost effective for PT PLN, *i.e.* where the cost of a saved kWH or kVA is less than the LRMC of generation and distribution or the cost of investment in new capacity, and where there is inadequate consumer response to current price

signals, there is a case for PT PLN to invest directly in demand side management. PT Energy Management Indonesia (Persero) has well developed energy conservation skills and would be a particularly valuable participant in this opportunity.

Progressive tariffs are already being used by PT PLN to meet the double challenge of delivering the constitutional public service obligation (PSO) to provide electricity to new consumers while minimising demand growth. Progressive tariffs provide a limited amount of energy (kWh) at low cost, and energy used above that amount is priced at successively higher unit rates. This approach to pricing is a particularly useful way of moving from a subsidised pricing to an overall cost-reflective price.

PT PLN has also introduced demand tariffs, as well as unit energy price (kWh), for industrial consumers, *i.e.* they pay for the demand or capacity (kVA or kW) that they require of the electricity distribution system. PT PLN should investigate ways in which a capacity tariff can be applied to commercial consumers. A capacity price would have a significant effect on shifting commercial sector air conditioning loads and may drive a range of efficiency and load-shifting responses in the commercial sector.

With the majority of PT PLN's electricity generated from oil, gas and coal, it is worth focusing on the efficiency opportunities that may exist in improved operation, retrofitting of advanced controls systems, and component upgrades. Achieving a 10% efficiency gain here from improved operation, maintenance and process improvements seems possible.

Indonesia's nine petroleum refineries are all owned and operated by the state-owned oil company, Pertamina. Petroleum refineries are a high-intensity energy transformation activity, and some of Pertamina's refineries are very old and lagging best practice efficiency. It is not clear that they face the strong commercial incentives of a market player to maximise their energy efficiency. Bringing Indonesia's existing petroleum refineries up to their optimal output is a key EE&C priority and it is a least cost approach to increasing petroleum product supply.

Demand side energy management

Recent IEA reports[11] on energy indicators and technologies highlight a valuable potential for energy efficiency improvement. Indonesia's own analysis reiterates this.

Industry

Capturing the apparently large EE&C opportunity in Indonesia's industry sectors requires a disaggregated sectoral approach. The efficiency and intensity relationships, various barriers and challenges in each sector need to be understood to optimize the investments and benefits from improvements. Examples that point to the opportunities that may be present are outlined below.

11. *Energy Use in the New Millennium: Trends in IEA Countries,* IEA 2007, and *Energy Technology Perspectives – Scenarios and Strategies to 2050,* IEA 2006.

Table 5.2 ..... Sectoral energy efficiency and conservation technical potential

Sector	Annual energy use (1000 BOE[1])	% TCE	Technical potential[2] 1000 BOE	Technical potential as % of sector energy
Industry	208	40	29-44	15-30
Transport	205	39	42	25
Household and commercial	119	21	13-40	10-30
Total	532	100		

1. BOE = Barrels Oil Equivalent. 171 937 BOE =1 PJ.
2. Technical potential describes the saving possible by replacing all existing with new technologies with state of the art efficiency characteristics.
Source: Ministry of Energy and Mineral Resources.

Table 5.3 ..... Key industrial energy intensities

	Indonesia	Comparable SE Asian	Best practice
Sector	**Energy intensity**	**Energy intensity**	**Energy intensity**
Steel: Electric arc furnaces	700 kWh/t	604 kWh/t (India)	500 kWh/t (Japan)
Low-quality ceramics	16.6 GJ/t	12.9 GJ/t (Vietnam)	
Tyres	8100 kcal/kg	7000 kcal/kg (Thailand)	
Cement	800 kcal/kg clinker		773 kcal/kg clinker
Glass	12.4 GJ/ton		10.2 GJ/ton

Source: *APEC Energy Security and Sustainable Development through Efficiency and Diversity: Economic Issues in Technology R&D, Adoption and Transfer,* ABARE, Report No. 07.12, 2007.

Iron and steel manufacturing provides a useful example of the importance of understanding intensities and any related efficiency opportunity. Indonesia's iron and steel industry has an actual intensity of 17 GJ/tonne, and, compared to other APEC economies (iron- and steel-sector intensities range from 6 to 34 GJ/tonne), is about average. But for the product mix in Indonesia, best practice would be 9.5 GJ/tonne.[12] The performance gap, 17 9.5 GJ/tonne, highlights the efficiency opportunity (about 40% savings in energy saving or increased output). In terms of this actual to best practice intensity gap, Indonesia ranks poorly alongside Russia and China. It would be very useful to study opportunities to rationalise this industry.

Similar analysis should be undertaken for other industrial sectors.

Appliances and equipment

It is important for Indonesia to ensure that appliance and equipment stocks are energy efficient so that minimum energy consumption is 'locked' into future appliance and equipment purchases. Mandatory minimum energy performance standards (MEPS) and labelling are the most cost effective ways of improving consumers' end-use energy efficiency.

A number of countries operate regulatory programmes for appliances and equipment, and co-operate in various joint projects to ensure that internationally harmonised and supported test standards and related efficiency performance standards are developed.

12. *APEC energy security and sustainable development through efficiency and diversity: economic issues in technology R&D, adoption and transfer,* ABARE. Report No. 07.12, 2007.

These processes involve both government and industry players in recognised institutions like ISO, IEC, ASTM to ensure high levels of agreement and technical validity of standards. Indonesia does not have to, and indeed shouldn't, develop its own standards for this activity. Applying international best practice standards in Indonesia's product efficiency regulations will ensure conformance with other economies and harmonise local manufacture with international markets. APEC Energy Standards Information System (ESIS) is an important reference system for developing this activity.

Standby power reduction is an important tool in reducing energy waste. IEA references, such as "Cool Appliances - Policy Strategies for Energy Efficient Homes" and "Things that Go Blip in the Night - Standby Power and how to limit it", provide useful background to ways in which standby power can be addressed. They also propose an international goal of 1 Watt standby power maximum. Korea, Australia and New Zealand are regulating watt standby levels for relevant appliances with target dates of 2010, and other economies have a range of efforts to minimise standby power and develop the 1 Watt initiative.

The US voluntary high efficiency brand ENERGY STAR already appears on many internationally traded products and forms an essential market leading function to accelerate the production and adoption by consumers of high efficiency products.

Houses and commercial buildings

Indonesia's housing stock is diverse. In 2006, PT PLN had about 33 million residential connections and most of these have relatively low levels of electricity demand. During the Review Team discussions in commercial buildings, it was observed that most used a very low level of lighting.[13] However, many were also overcooled, an ideal opportunity for EE&C savings through the simple action of increasing temperature set points.

There appear to be no EE&C requirements in Indonesia's building codes. This is a critical and urgent opportunity to minimize future building energy consumption in a climate which places heavy demands on occupant comfort and building energy systems.

Transport

Transport energy accounts for 48% of national fuel demand and is growing at a rate of 11% per year.[14] When this demand rate is compared to population growth of 1.25% per year and transport infrastructure growth of 1% per year,[15] coupled with the current subsidization of fuels, it is clearly an unsustainable situation. If fuels were provided at market price, supply and demand would be better matched. But with the current subsidised fuel prices, demand is rapidly exceeding the carrying capacity of transport infrastructure.

13. An informal survey of lighting power densities in rooms visited, gave lighting power densities in the range 3.5-10 Watts/m^2 with a mean of 7 W/m^2. 10-12 W/m^2 is good practice. Coupled with generally low illuminance levels, if this is representative of commercial building practice in Indonesia, there is little scope for lighting load reduction.
14. Briefing meeting Presentation, Indonesian Ministry of Transport 2/7/2007.
15. Briefing meeting Presentation, Indonesian Ministry of Transport 2/7/2007.

Road transport is the largest share of transport energy at 88% of fuel demand. Sea transport follows at 7%, air transport at 4%, and rail at 1%. The Ministry's policy focus is rightly shaped by the burgeoning demand in road transport. Indonesia's transport fleet is made up of over 34 million motorcycles, 6.3 million cars, and trucks and buses.

Expand public transport

When it comes to expanding public transport, Jakarta is a major challenge. At 650 km^2, a base of 8.32 million inhabitants growing by 2% per year, its population swells to 30 million every day as workers commute from outlying centres. TransJakarta Bus Rapid Transit is proving to be a partial solution and an optimal system for Jakarta possibly lies in a high capacity city bus system that complements a high-capacity commuter electric rail system. Analysis by APERC[16] highlights the challenges and opportunities that cities with these characteristics face, and Jakarta fits these criteria.

The Ministry of Transport is pursuing a sound programme to expand rail and bus transit systems in Jakarta and in 15 other large population centres. Rail currently provides only 2.5% of commuter trips in Jakarta. The Ministry have a target to increase this to 5% by 2010. Work is already underway upgrading the Jabotabel rail system to include double tracking the feeder rail lines to the cities circular rail ring, upgrading the existing 16 stations and building 4 new stations.

The TransJakarta Bus Rapid Transit system has already demonstrated its value as a flexible and cost effective public transport system. The Ministry of Transport reported a reduction in trip times to 30% of that of a car trip and a movement of 14% of bus users from cars. It is in the process of being expanded from 7 to 15 routes in Jakarta and the first route outside Jakarta in Bogor has just been opened. As mentioned, the key to maximising the utility of rail and bus systems is integrating their services so that the bus transit system rapidly distributes commuters to locations intermediate to the rail stations.

It should be noted that monorail systems are not inherently high-capacity systems and the current proposal could serve as a distraction of resources and capital. The Jabotabel rail network expansion must be prioritised as it is core to creating a sustainable transport system not only for Jakarta but other large centres.

Increase vehicle fuel efficiency

Indonesia cannot afford to allow a less than fuel-efficient vehicle fleet to continue. A range of measures should be introduced and enforced, including a minimum vehicle fuel efficiency standard at point of import or first registration, differential engine-size taxation at purchase or registration, and fuel efficiency labelling. Without such intervention, Indonesia runs the risk of receiving vehicles that do not comply with other countries' fuel efficiency standards. Enforcement is key to this.

16. *Urban Transport Energy Use in the APEC Region,* APERC 2007.

The Police administration operates vehicle registration which includes annual re-licensing of all vehicles. Public vehicles are required to undergo a safety check by local government, which includes emission testing, but private vehicles are exempt.

The ubiquitous "paratransit" small buses and the "tuk tuk" motor tricycles are a less fuel-efficient mode than medium-sized or large buses. As rail and bus systems evolve, they will tend to be displaced and operate shorter routes. However, currently, without substitutes, they are an integral and flexible part of Indonesia's transport system.

Alternative fuels and modes

Alternative fuels are attractive for reasons including security of supply, reduced emissions (from CNG and LPG), and reduced CO_2 (from biofuels). TransJakarta buses operate on CNG and a growing range of buses are using biodiesel.

However, Indonesia's experience with CNG conversions for taxis highlights the problems and pervasiveness of Indonesia's non-economic fuel pricing policies. Attempts by taxi operators to capitalise on the low cost of CNG[17] have been stymied by the failed supply of CNG due to its unsustainably low retail price: the number of retail CNG filling stations in Jakarta has collapsed from 17 to 1.

The Ministry of Transport has set up a specialist team to ensure integration of the fuel supply value chain in future programmes. With this in place, the Ministry should investigate the options and economics of expanding alternative fuel options including blending biofuels (biodiesel and bioethanol) into mainstream diesel and petrol supplies. Many economies already do this.

There will be opportunities to enable and improve consumers' experiences with zero and low energy transport options like cycling and walking. Non-motorised transport should be developed in conjunction with a master sustainable transport plan for the cities and integrated with bus system planning. Given the large population in Indonesia's rural communities, strategies to develop and sustain these low-energy transport options are as valid to an Indonesian sustainable transport future as are plans for developing powered transport systems.

Freight

The Indonesian archipelago faces unique freight transport options. An effective domestic coastal shipping system with a feeder relationship to international freight handling ports is critical to Indonesia's development. Without cost-effective transport, Indonesian manufacturers will not have access to markets.

17. CNG is priced by government at 2500IRP/litre and petrol at 4500IRP/litre.

The government has a policy to use rail for freight. Most land freight transport is by truck; low truck efficiency, congestion at freight handling facilities and ports and high pollution, all point to a need for change. The Ministry of Transport is considering the possibility of developing dry ports – inland rail heads that connect directly to ports as a means of reducing road freight impacts and improving the sustainability of freight transport.

The different roles played by trucking, rail and shipping in freight and the challenges in improving the sustainability of freight highlight the need for a integrated sustainable freight strategy for Indonesia.

Conclusions and recommendations

The current foray into EE&C is still developing. The elements in the Energy Plan and Blueprint are not dissimilar to those in other economies EE&C strategies, and the challenges to improving EE&C are similar. There are challenges, particularly in developing the necessary focus and sufficient scale of activity if the potential is to be achieved.

The challenge from multiple players in the EE&C institutional space is in ensuring they are effectively focused, integrated and accountabilities are made clear. In the Government Structure and Process chapter, the case is made for establishment of a Directorate General of Energy Efficiency, Conservation and Renewable Energy. From the EE&C perspective, the rationale for this new function is based on the need to ensure a strong focus on the demand side that also has the authority to garner and mobilise the necessary resources.

Key sectoral and end-use actions can be summarised as:

- Benchmarking the efficiency of large energy-using assets such as refineries, generators and large industrial facilities.
- Taking a disaggregated approach to analysing and capturing the demand side EE&C potential.
- Instituting regulations for appliance equipment and building efficiency.
- Instituting regulations for vehicle fuel efficiency.
- Developing sustainable transport options.

The IEA Review Team recommends that the Government of Indonesia:

- Consider the establishment of a Directorate General of Energy Efficiency and Renewable Energy to ensure an authoritative focus on EE&C programmes in Indonesia and their effective resourcing and monitoring of their implementation:
  - Assign roles and accountabilities of the institutions working in EE&C and ensure they are resourced to deliver their respective accountabilities;
  - Prepare an updated National EE&C Plan, consult widely with community, industry and other stakeholder groups and promote the activities of the plan. Ensure that research, analysis, communications and capacity building capabilities are resourced to

support the plan and programme delivery. Ensure analysis separately identifies service improvement from energy savings; and

- Institute a regular cycle of reviewing progress and updating the National Energy Efficiency and Conservation Strategy. Review, prepare an updated or revised National EE&C Plan, consult widely with community, industry and other stakeholder groups, resource and promote the activities of the plan.

- Establish an energy indicators database in PUSDATIN using detailed energy end -use data and economic data at the sub-sectoral and technology level. Enhance the capacity of PUSDATIN to build accurate and comprehensive energy efficiency indicators and to develop their policy implications.
- Establish the expertise to analyse longer term energy technology options based on the BPPT and its MARKAL modelling team. This expertise should draw on international experience in the modelling of least cost energy-efficient technologies and their deployment.
- The Agency for Education and Training should develop with all EE&C stakeholders a capacity building plan that supports and delivers EE&C plans and strategies. Monitor and review the efficacy of the plan and update as required.
- PT PLN should expand its progressive tariffs and demand tariffs of electricity to all sectors following approval by the GOI. PT PLN should identify applications where it is more cost effective to invest in demand-side load or capacity reduction and make available funds for these investments if required.
- The GOI should engage a recognised international power generation consultancy to benchmark Indonesian generation plant performance against relevant world best practice and undertake audits to identify cost-effective energy savings and performance improvements. The government should hold PT PLN accountable for performing to those benchmarks.
- The GOI should engage a recognised international refining consultancy to benchmark Indonesian refinery performance against relevant world best practice and undertake audits to identify cost-effective energy savings and performance improvements. The GOI should hold Pertamina accountable for performing to those benchmarks.
- Review industrial energy intensities and international best practice, in order to identify process improvements at a sub-sector and plant level in Indonesia.
- Develop an effective appliance and equipment regulatory programme to minimise energy use from the growing stock of energy using products. The programme should include the following:

- A review of appliance and equipment energy use in Indonesia and the implications, cost and benefits from applying available international best practice standards;
- Development of a regulatory scheme that enables the referencing of international best practice standards for energy efficiency, and the necessary regulatory processes for compliance and enforcement;
- Effective integration of standby power management by adoption of 1 Watt standby requirements; and
- Effective integration of complementary voluntary actions including ENERGY STAR.

- Develop building EE&C regulations for residential and commercial buildings, including regulatory compliance and enforcement processes, based on life-cycle-cost-effective energy efficiency measures.
- Continue to develop and implement with the highest priority the existing plans to develop the Jabotabel rail network and TransJakarta bus transit system, and develop a strategy to expand these to other high-population centres. Continue to monitor success and identify opportunities to expand these networks and develop new networks.
- Undertake analysis into the efficacy, cost and benefits of options to increase the efficiency of vehicles by implementing: minimum fuel efficiency regulations for cars, buses and motorcycles; purchase or registration taxation based on fuel consumption; and mandatory fuel efficiency labelling at point of sale or point of importation. Include investigation into developing a clean burning efficient option for repowering tuk tuks.

VI. RENEWABLE ENERGY

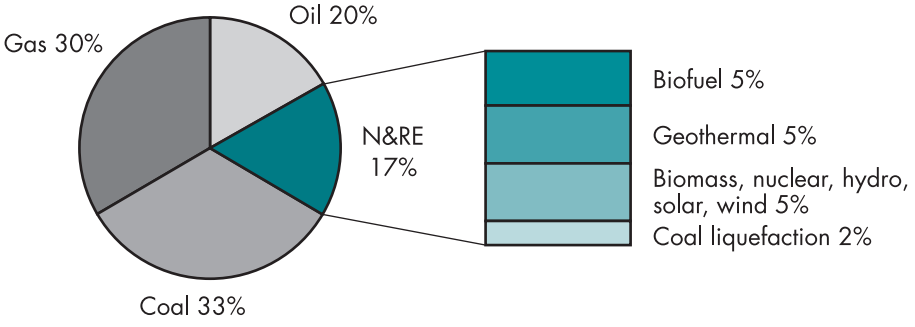
OVERVIEW

Indonesia's energy demand is highly dependent on fossil fuels and its proven fossil fuel reserves are limited and declining. There is, however, a huge potential for renewable energy (RE) to play a larger role in the energy mix. For much of Indonesia, with its relatively isolated islands and regions, provision of basic energy needs by RE is an appropriate option.

Indonesia's utilisation of non-fossil energy sources, particularly RE, remains small. This is largely due to the inefficient allocative impact of Indonesia's highly subsidised petroleum prices and gas and electricity tariffs, coupled with the lack of a conducive investment climate with a reasonable feed-in tariff and standardised power purchase agreements (PPA). At the same time, the Government of Indonesia (GOI) is seeking increased use of RE. In the short term, Indonesia's utilisation of RE is directed to fulfilling rural energy needs, but, in the longer term, RE is expected to displace petroleum fuels and constitute a significant share of Indonesia's primary energy supply.

The Energy Blueprint 2005-2025 was developed to provide guidance on securing a sustainable energy supply. Under its "Optimizing Energy Management" scenario, the projected primary energy supply in 2025 shows RE playing an increasingly important role, particularly for geothermal and biofuels. The share of RE is projected to grow from the current 4.3% to 17% in 2025.

Figure 6.1 ..... National primary energy supply in year 2025



Source: Ministry of Energy and Mineral Resources.

Currently, only some 5 700 MW of RE technologies are installed, representing only 2% of the estimated technical potential of the various RE technologies.

Table 6.1 ..... Potential and installed capacity of renewable energy options (MW)

RE source	Potential	Installed capacity
Hydro	75 670	4 200
Geothermal	27 000	1 052
Mini/Micro hydro	450	86
Biomass	49 810	445
Solar	4.8 kWh/m²/day	12
Wind	9 290	0.6

Source: Ministry of Energy and Mineral Resources.

INSTITUTIONAL FRAMEWORK OF RENEWABLE ENERGY DEVELOPMENT

The main GOI institution that regulates the development of renewable energy (RE) is the Ministry of Energy and Mineral Resources (MEMR) and its agencies:

- Directorate General of Electricity and Energy Utilisation (DGE&EU) which formulates policy and programmes for RE development;
- Directorate General of Minerals, Coal and Geothermal (DGMC&G) which formulates policy and programmes for geothermal development;
- Research Centre of Electricity and Renewable Energy which executes R&D in RE technology; and
- Training Centre for Electricity and Renewable Energy which executes training in RE for human resources and technology application.

In the Government Structure and Process chapter, the case is made for the establishment of a separate Directorate General of Energy Efficiency, Conservation and Renewable Energy. Both energy efficiency and renewable energy are essential to achieving the proposed 2025 energy balance. The extensive policy and implementation requirements of energy efficiency and renewable energy options are not at present reflected in the institutional structure where both are covered by a single Directorate within DGE&EU. A more prominent position is advisable and a Directorate General for Energy Efficiency and Renewables might be considered.

Several stakeholder organisations and networks have been established to raise awareness among the public at large for specific RE technologies and to advise the DGE&EU on policies aimed at accelerating the introduction of renewable technologies:

- Indonesian Renewable Energy Society (Masyarakat Energi Terbarukan Indonesia - METI) is a forum established to promote RE in Indonesia. It has some 40 members from private sector, research institutions and government, and it aims to facilitate the co-ordination between the various associations and forums, including Indonesian Geothermal Association, Micro Hydro Association, Solar Cell Entrepreneur Association, Biomass Association, Indonesian Biodiesel Forum, and Wind Energy Entrepreneur Association;
- Indonesian Biodiesel Forum (FBI) was established in February 2002 and currently comprises some 420 members from government, research organisations,

non-governmental organisations, and the private sector. FBI aims to promote the production and use of biodiesel in Indonesia in order to achieve sustainable energy supply security and economic development. This is done through raising awareness among the public at large about the role biofuels can play and through facilitating the exchange of information among the various stakeholders;

- 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 biofuel. The team consists of representatives from several Ministries and other governmental bodies, research organisations and the private sector;
- The Indonesia Geothermal Association (Asosiasi Panasbumi Indonesia - API) was established in 1991 to promote geothermal 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; and
- The Ministry of Research and Technology, the Agency of Assessment and Application of Technology (BPPT), and universities are involved in formulating R&D and implementation of RE.

A key component of the political and economic reforms that are currently being implemented in Indonesia is the devolution of responsibilities for regional development, including RE development. Article 18 of the new Energy Law No. 30/2007, which was enacted by the House of Representatives (DPR) in August 2007, requires that local governments formulate their own regional energy master plan (based on the National Energy Master Plan) aimed at securing sustainable energy supplies and promoting energy conservation and the use of RE.

This means moving responsibilities and associated budgets from the central government to the provincial and district governments. The development of RE projects in the regions is therefore now often initiated by a local government together with other local stakeholders. Financing may come from the regional government budget (especially for off grid RE systems).

RENEWABLE ENERGY POLICY AND ITS TARGETS

The GOI has set the target that, in the short term, RE will be developed on a small scale to fulfil basic rural energy needs. According to 'Statistics Indonesia' (Badan Pusat Statistik), 19.5% of the rural population (22.7 million people) lived below the national poverty line of Rp 117 000 per month[18] in 2005. By improving access for the rural poor to modern forms of energy, in particular electricity, RE can play an important role in creating new economic activities.

The GOI is making efforts to create a conducive climate for implementing RE by introducing policies such as its Green Energy Policy (Ministerial Decree No. 2/2004), its Ministerial Decree No. 1122/K/30/MEM/2002 on Small Distributed Power

18. According to the international poverty line for Indonesia, in 2002, 7.9% of the population lived below the USD 1 a day poverty line and 52.4% lived below the USD 2 a day. *(World Development Indicators 2007,* World Bank.*)*

Generation Using Renewable Energy, its Ministerial Regulation No. 2/2006 on Medium Scale Power Generation using Renewable Energy, and its Governmental Regulation No. 03/2005 on Electricity Supply and Utilisation and its amendment, Governmental Regulation No. 26/2006.

The objective of the Green Energy Policy is to realise sustainable energy supply and utilisation by implementing the maximum utilisation of RE, the efficient utilisation of energy, and raising public awareness of energy efficiency.

The Ministerial Decree on Small Distributed Power Generation Using Renewable Energy was launched with the objective of promoting RE small-scale power plants by allowing enterprises to sell their power production or surplus power to the local utility's power grid (if already 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 80% of the utility's production cost if it is connected to medium voltage grid.

The Ministerial Regulation on Medium Scale Power Generation using Renewable Energy has a similar objective for RE medium-scale power plants. The maximum allowable capacity of each power plant is 1-10 MW and the electricity price provisions are as for small-scale plant. A purchase contract for 10 years or longer can be negotiated.

The GOI has formulated programmes that aim to develop stand-alone energy supply systems based on locally available RE sources:

- The Micro Hydro Project Programme, jointly implemented by GTZ, national and local governments, NGOs and local entrepreneurs, started in the early 1990s. It has so far supplied electricity to some 20 000 rural households and small and medium enterprises (SMEs) through the development of micro-hydro projects in rural areas;
- The Energy Self-Sufficient Village programme started in 2005 and aims to enable villages to meet their own energy needs by developing locally available RE resources. So far, some 200 villages produce enough energy for meeting their own energy needs and it is expected that this number will rise to 2 000 by year 2009; and
- The Solar Home Systems programme commenced in mid-1990s and has so far installed some 100 000 systems (some 5 MW) throughout Indonesia. Recently, a follow-up programme has started with the aim to install another 30 000 systems.

In the long term, RE will be developed to substitute fossil fuels. The National Energy Blueprint states that, by year 2025, at least 15% of total energy supply must be based on RE.

Since the Ministerial Decree on Small Distributed Power Generation Using Renewable Energy was launched in 2002, some RE power plant (mainly micro hydro/mini hydro constructed by small-scale enterprises) has been interconnected to the PT PLN grid, and others are being constructed. Mini hydro will be further developed and is expected to contribute some 0.2% to total energy supply by year 2025.

To stimulate the use of biofuels as a fossil fuel extender or alternative, two Decrees issued by the GOI are relevant: Presidential Decree No. 5/2006 on the National

Energy Policy and Presidential Instruction No. 1/2006 on the Supply and Utilisation of Biofuels as an Alternative Energy.

In the recent Energy Blueprint, biofuels are explicitly mentioned as a RE source that is expected to contribute 5% of the national energy supply by year 2025. Biodiesel development has made large progress. More than 5 million hectares have been allocated by the GOI for biodiesel and bioethanol production from crops such as palm oil, jatropha, sugar cane, cassava and others.

The potential for geothermal is large and the GOI has developed policies to increase the utilization of this energy source to some 5% of total energy supply by 2025. Wind energy will be further developed but its contribution to total energy supply will remain modest.

THE RENEWABLE ENERGY MARKET AND OPPORTUNITIES

Biofuels

Biofuels comprise biodiesel, bioethanol and bio-oil. Biofuels can provide alternatives or extenders for transport petroleum fuels and they are currently the primary RE focus in Indonesia. This was triggered by the fast increasing world crude oil prices and decreasing oil production in Indonesia. 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.

Indonesia is endowed with various sources of biofuels such as palm, corn, molasses, cassava, and jatropha. Production of palm oil has become economically very attractive as prices started to rise rapidly by the end of 2006. However, concerns have been raised about the sustainability of this development. Since palm oil producers are choosing to sell their product on the international market, less palm oil is available domestically, resulting in rapidly increasing cooking oil prices.

The international community has recently begun expressing concerns about deforestation and land management policy related to production of biofuels and some regions have indicated that they may set sustainability standards for palm oil to ensure that more durable production methods are used. A rapid increase of non-edible crops, especially jatropha, as a source for biofuels production is urgently required to address the environmental and food security issues related to palm oil. Much research has already been done by the MEMR R&D Centre for Oil and Gas Technology, BPPT, ITB, universities, and others on the technical and economic aspects of non-edible crops.

Biofuel targets and the National Biofuel Development Committee

In 2006, Presidential Decree No. 10/2006 was issued to establish the National Team for Biofuel Development. This committee is chaired by the co-ordinating Ministries of Economy and People's Welfare and its brief is to:

- Create a blueprint and roadmap for a national biofuel development programme;
- Advise regional governments on how to increase economic development through biofuel programmes;

- Analyse the economic, social and environmental aspects of biofuel production from various feed stocks; and
- Formulate regulations for all aspects of the fuel chain, including plantation, processing, marketing, and distribution.

The committee has formulated ambitious targets for biofuel supply. Total supply of biofuels is expected to increase from 0.6 million kL in 2007 to 9.8 million kL after 2010 and 20+ million kL by 2025. This is about 3% of total energy supply in 2010 and 5% in 2025.

Figure 6.2. ..... Roadmap for biofuel development

	2007 - 2010	2011 - 2015	2016 - 2025
Biodiesel consumption	10% of all diesel consumed or 2.41 mln kL	15% of diesel 4.52 mln kL	20% of diesel 10.22 mln kL
Bioethanol	5% of gasoline 1.48 mln kL	10% of gasoline 2.78 mln kL	15% of gasoline 6.28 mln kL
Biokerosene	1 mln kL	1.8 mln kL	4.07 mln kL
PPO for electricity generation	0.4 mln kL	0.74 mln kL	1.69 mln kL
Biofuel consumption	2% of overall energy mix 5.29 mln kL	3% of energy mix 9.84 mln kL	5% of energy mix 22.26 mln kL

PPO: Pure plantation oil for power plants.
Source: National Team for Biofuel Development.

To achieve these targets, 5.25 million hectares of land will be allotted in 2010 and more than 7 million hectares in 2025 to growing palm, jatropha, sugar cane and cassava. Investments are needed for on-farm and off-farm activities of some Rp 166 billion up to 2010 and some Rp 341 billion up to 2015. It is expected that some 3.5 million new jobs can be created up to 2010, especially non-skilled jobs in the plantation sector.

Biofuel can be produced from various raw materials and it is expected to substitute part of gasoline, diesel and kerosene consumption as shown below.

Quality standards have to be met if biodiesel is blended with diesel fuel. Ministerial Decree No. 3675K/24/DJM/2006, issued by MEMR in 2006, regulates the use of biodiesel up to a maximum of 10% of the volume of biofuel. The quality and specification has to meet the biodiesel standard SNI 04-7182-2006, which is based on the European and US standards ASTM D 6751 and EN 14214.

Table 6.2 ..... Biofuel utilisation and potential market in 2015

Type	Fossil fuel substitute	Potential market	Raw material
Bioethanol	Gasoline substitute	Road transport 10%	Sugar cane and cassava
Bio oil **- bio kerosene** **- bio oil**	Kerosene substitute ADO substitute IDO substitute Fuel oil substitute	Household 10% Road transport 10% and power plant 10-50% Sea transport and railway transport 10% Industry 50%	Palm oil and jatropha
Biodiesel	ADO substitute	Road transport 10% and power plant 50%	Palm oil and jatropha

ADO: automotive diesel oil.
IDO: industrial diesel oil.
Source: Ministry of Energy and Mineral Resources.

Energy Self-sufficient Village

To fast track the development of biofuels, the GOI has designated special biofuel zones and designed the concept of an energy self-sufficient village. The concept of the Energy Self-sufficient Village (ESSV) plays a key role in the biofuel development programme. An ESSV is a village capable of meeting its own energy needs and, in the process, of creating job opportunities, reducing poverty and inducing productive activities. There are two types of such villages, namely villages that have energy sources such as micro-hydropower, solar or biogas, and villages using biomass sourced energy resources like biofuel.

The GOI wants to increase the number of ESSV to 2 000 in 2009, consisting of 1 000 villages of the first type and 1 000 others of the second type. In the short term, this would result in an estimated creation of around 1 million new jobs and significant reduction of poverty. Currently some 70 000 villages in Indonesia are not electrified, of which some 45% are under the poverty line. The ESSV concept aims, in the longer term, to lead to a massive reduction in the use of fossil fuels at the village level.

The GOI encourages the regions to develop their own biofuels according to the potential in the region. The necessary funding can come from the regional government budget. The national government provides financial support for purchasing seeds for planting jatropha.

Special Biofuel Zones

Several ministries and government agencies have particular responsibilities in the biofuel development chain and this risks laborious procedures for obtaining the necessary licenses and permits. To streamline this process and to establish a one-stop-shop approach, the Biofuel Committee proposes to designate Special Biofuel Zones (SBZ). These zones are areas throughout Indonesia (at least 10 000 hectares in Java and 100 000 hectares outside Java) that meet certain criteria such as existing infrastructure, labour requirements, and conservation guidelines. Within these zones, the GOI will invest in the necessary infrastructure and the private sector is expected to invest in the construction of a demonstration plant. The intention is to have 12 SBZs by the year 2010.

Licenses have been issued to more than 10 biodiesel producers with capacity in the range of 50 000 to 150 000 tonnes of biodiesel per year. Currently, PT Eterindo Wahanatama is the biggest producer of biodiesel with the production capacity of

137 tons per day. Biodiesel is already sold at more than 220 filling stations in Jakarta and Surabaya and bioethanol is available at one filling station in Jakarta.

Usage of alternative biofuels in Indonesia is supported by:

- Law No. 22/2001 on Oil and Natural Gas;
- Estate Crop Law No. 18/2004;
- Governmental Regulation No. 36/2004 on Downstream Oil and Gas Business Activity;
- Presidential Instruction No. 1/2006 on Supply and Utilisation of Biofuel as Alternative Fuel;
- Presidential Decree No. 5/2006 on the National Energy Mix;
- Presidential Decree No. 10/2006 on Establishment of National Team for Biofuel Development;
- Minister of Finance Decree No. 117/PMK.06/2006 on Credit for the Development of Biofuel Energy and Plantation Revitalisation;
- Minister of Energy and Mineral Resources Decree No. 051/2006 on Guideline and Procedure for Biofuel Businesses;
- Director General for Oil and Gas Decree No. 3674K/24/DJM/2006 on Gasoline Specification for Domestic Market;
- Director General for Oil and Gas Decree No. 3675K/24/DJM/2006 on Diesel Fuel Specification for Domestic Market;
- Director General for Oil and Gas Decree No. 13483K/24/DJM/2006 Biodiesel Specification for Domestic Market;
- National Standard (SNI) for Biodiesel No. 04 – 7182 – 2006;
- National Standard (SNI) for Bioethanol No. DT27 – 0001 – 2006;
- Governmental Regulation No. 1/2007 on Income Tax Facilities for Investment Activities in Specific Industries and/or Particular Region;
- Governmental Regulation No. 8/2007 on Government Investment; and
- Alternative Energy National Team (Strategy and Roadmap of Biofuel Development).

The Biofuel Committee has produced a blueprint for biofuel development and a set of recommendations regarding funding, pricing, processing, consumption and production of the various biofuel crops. Based on these recommendations, a comprehensive policy should be formulated that provides clear guidance on the role of the various biofuel crops in achieving a sustainable biofuels market and the instruments that are needed to bring about a switch to non-edible crops.

Biomass waste energy

According to a study conducted in 2000 by ZREU, Germany, some 147 million tonnes of biomass is produced every year in Indonesia. The biomass comes mainly from rice residues (65.6 million tonnes), sugar residues (23.6 million tonnes), rubber wood (41 million tonnes), and palm-oil residues (8.2 million tonnes). Smaller quantities are available from other agricultural waste such as logging residues, sawn-timber residues, coconut residues and other agricultural waste.

This is equivalent to some 470 GJ/year that is potentially available for meeting electricity and heat demands of rural households and industries. In the same study, the identified market potential for generating electricity and heat from biomass residues is estimated at some 1 160 MW for the whole of Indonesia. The traditional use of biomass residues is through combustion but many studies show that gasification has many advantages, including higher efficiency and more cost-effective reduction of emissions.

Another potential source of biomass energy is organic municipal waste. According to the Jakarta Development Planning Agency (Bappeda), the city of Jakarta produces some 6 300 tonnes of waste per day and this amount is rapidly growing. Regulation regarding the management of the waste is not yet in place and currently the waste is either burnt by households, collected by the municipality and dumped into designated dumping ground or landfill, or is informally dumped.

A closure of open dumping sites and construction of well-managed sanitary landfills could be a (part of) solution to the waste problem. The landfill gas could be used to produce electricity in an environmentally friendly manner. The GOI has selected five private companies to build a waste-treatment plant and produce landfill gas that can be used as an alternative energy source.

Hydropower

Hydropower has the highest potential energy resources but has not been effectively harnessed. Hydropower potential is estimated at 75 674 MW, but total installed hydropower capacity is only 4 200 MW, or around 5% of its potential. As with other RE resources, much of the hydropower resource suffers from the economics of distance to its load centre.

Currently installed capacity of mini and micro-hydro (50 kW-500 kW capacity) amounts to some 86 MW, 17.2% of total identified potential of 500 MW. The technology is well developed and broadly available and therefore can be expected to play a significant role in meeting the rapidly growing rural electricity demand.

Most micro-hydro systems are not connected to the grid. They are generally in remote areas and thus are of particular relevance for improving quality of life and generating income for poor communities. Pico-hydro is the least cost option in Indonesia for stand-alone RE electricity production, with an average cost for 5 kW systems of US cent 2.5/kWh and for 15 kW systems of US cent 1.3/kWh.

Regulations related to hydropower:

- Ministerial Decree No. 1122/K/30/MEM/2002 on Small Distributed Power Generation Using Renewable Energy; and
- Ministerial Regulation No. 2/2006 on Medium Scale Power Generation using Renewable Energy.

Geothermal power

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. Most geothermal potential can be found on Sumatra (13 800 MW), Java and Bali (9 250 MW) and Sulawesi (2 000 MW). Total possible/probable 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. Reflecting the high priority the GOI assigns to geothermal power, the GOI investment in geothermal development has risen rapidly in recent years from nearly USD 65 million in 2005 to USD 181 million in 2006. Investment totalling USD 172 million was expended in 2007, and a further USD 209 million investment is planned for 2008.

Regulations related to geothermal power:

- Law No. 27/2003 on Geothermal; and
- Governmental Regulation No. 59/2007 on Geothermal Development.

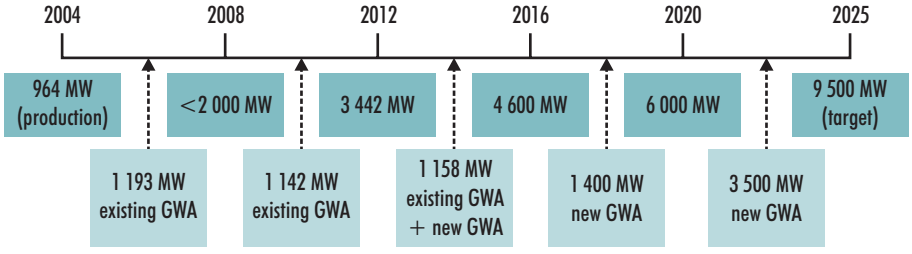
The development of geothermal power is based on Law No. 27/2003 on Geothermal which regulates the management and development of Indonesia's geothermal energy resources for direct and indirect utilisation. The aims of the legislation are:

- To manage geothermal activities to support sustainable development; and
- To increase national income to support national economic growth.

Roadmap of geothermal development

According to the roadmap of geothermal development, the forecast installed capacity amounts to some 6 000 MW in 2020 and 9 500 MW in 2025. While the planned commissioning of 2 000 MW for 2008 is looking less likely, the GOI is committed to rapidly increasing Indonesia's geothermal capacity.

Figure 6.3 ..... Roadmap of geothermal development



GWA = Geothermal Working Area.
Source: Ministry of Energy and Mineral Resources.

Authorisation for geothermal power activities is a function of the location of the geothermal resource. If the activity is 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 by the provincial government. Where the geothermal resource crosses a provincial boundary, approval is required by the central government.

Two business schemes for the production of electricity from geothermal energy are in place:

- Development and operation of the steam field is managed separately from the production of the electricity; and
- Total project management, whereby the development and operation of the steam field and power production is under the same management.

In general, geothermal projects can be developed at a cost that is quite competitive with fossil fuels. However, to encourage new investors into geothermal power projects, challenges remain to creating the necessary clarity in the regulatory regime. Review Team discussions particularly highlighted the issues of setting a competitive feed-in tariff, the bidding procedures for new projects, and taxation provisions for new projects.

Wind energy

The potential for wind energy is relatively small in Indonesia because of low wind speeds ranging from 3-6 m/second. Installed wind systems are mainly stand-alone systems in rural and remote areas: they are in the range of 1.5-29.5 kW and used for electricity production, water pumping (irrigation), and battery charging.

PT PLN has installed 3 wind power units in Bali of 85 kW each and is planning to install a further 15 similar units throughout Bali. It is also planning to install 3 x 250 kW units in West Nusa Tenggara and 2 x 100 kW units in East Nusa Tenggara. In West Java, PT PLN has plans to build a 300 kW wind project. Over 2005-07, MEMR built a wind power project in Bali with a capacity of 6 x 80 kW and a second project in North Sulawesi of 2 x 80 kW units. However, for most of the planned wind power projects, investors are still being sought. Average cost for wind power is estimated to amount to approximately Rp 30 million (USD 3 250) per installed kW.

Solar energy

Indonesia has a long experience with off-grid solar photovoltaic electricity systems and, as an equatorial country, has an average solar radiation of 4.8 kWh/m2/day. At present, a total of around 12 MW of solar photovoltaic systems have been installed in Indonesia, including some 100 000 Solar Home Systems (SHS) installed for purposes such as lighting, television, communication, battery charging and refrigeration. A GOI budget of some USD 12 million is available for installing another 30 000 SHS systems. The manufacturers of the systems have been selected and installation will start soon.

To overcome the barrier for householders of the high upfront capital cost of the Solar Home Systems, the GOI has decided to purchase the systems from private companies through a bidding process and then provide the systems to the households for free. However, international experience has shown that this approach is generally not sustainable, as reflected in frequent system break-downs because of a lack of after-sales service and a limited (sometimes zero) financial commitment on the part of the households. Although more complex to initially establish, sustainable approaches for household systems generally include:

- a significant component of financial buy-in of their household system by the individual householder;
- the establishment of a trained and profit orientated fee-for-service installation and maintenance agent in the locality; and
- the installation of a sufficient number of systems in a locality to provide a viable business for the agent.

The use of solar thermal energy for cooking and drying agricultural products is still limited. The market for solar domestic and commercial hot water heaters has reached the commercial stage and there are many private companies currently supplying these systems.

FINANCING RENEWABLE ENERGY

Different schemes are currently applied for financing RE in Indonesia:

- National development government budget: This is currently the main source of finance for RE. After approval by the Development Planning Agency (BAPPENAS), the budget is allocated to government agencies such as the Ministry of Energy and Mineral Resources, Ministry of Health, and the Agency of Technology Assessment and Application (BPPT) to finance their RE projects.
- Regional government budget: Since Indonesia's decentralisation process started, and especially since the issuance of Law No. 22/1999 on Regional Governance and Law No. 25/1999 on the Fiscal Balance between the Central Government and the Regions, the funding for provincial and district governments has significantly increased. This has increased the available budget for financing RE projects in the regions.
- Grants/technical assistance or loans from bilateral and multilateral donors: These funds are channelled through BAPPENAS. Project proposals prepared by government agencies are sent to BAPPENAS which evaluates the proposals and tries to find a donor to fund the proposal. Because there is a high political priority for activities related to global climate change, more funds have become available in recent years for financing RE projects.
- Local entrepreneurs: Local entrepreneurs, who see business prospects from RE projects, are a limited, although fast growing, source of funding.

KEY BARRIERS TO RENEWABLE ENERGY TECHNOLOGIES ENTRY

A key barrier to the uptake of RE technologies in Indonesia is the high upfront capital cost of RE technologies versus their expected return on investment. RE technologies are characterised by high capital investment and relatively low operating cost, but the low and often subsidised price of competing commercial fuels in Indonesia can result in payback periods for RE technologies being longer than the life of the technology.

Legislation for stimulating small-scale RE systems is in place (Ministerial Decree No. 1122/K/30/MEM/2002 on Small Distributed Power Generation Using Renewable Energy and Ministerial Regulation No. 2/2006 on Medium-Scale Power Generation Using Renewable Energy), but it appears not to be very effective in attracting new investment.

Currently, the financial support for these systems is related to the production costs of the utility responsible for distributing the electricity. As these production costs are not transparent, long and difficult negotiations between the investor and the utility are required to reach an agreement that will provide the necessary return for the investor. This significantly hinders a more rapid uptake of these RE power systems.

Alternatives should be considered, such as a well-designed feed-in tariff system, whereby the utility is obliged to purchase the RE generated electricity at a tariff set by an independent organisation. Feed-in tariffs have been widely adopted in Europe, and China is considering introducing this system. Feed-in tariffs would be a good fit in Indonesia; they provide greater investor certainty than other, more market-based approaches, like renewable quota obligations. Traditionally, the costs of feed-in tariffs are recovered through a surcharge on the electricity tariff to all consumers.

Government support would also usefully focus on investment conditions within which SMEs can develop a commercial and sustainable market for RE technologies in competition with conventional energy sources. Such support would address other issues adding to the high start-up costs of RE technologies, such as import duty (most RE technologies are imported), value added tax (VAT), and strengthening microfinance institutions to improve private sector access to loans/micro credit/grants.

Indonesia's limited RE technology manufacturing and servicing capability and the lack of skilled technicians for the installation and maintenance of RE technologies hampers the entry and sustainability of RE technologies. Government support may very usefully focus on RE training programmes and RE research and development for industry and technicians, and raising community awareness and interest in RE implementation in institutions, rural communities, schools, and clinics.

Conclusions and recommendations

Indonesia has a large and diversified potential for RE options, but so far only a small fraction has been tapped. In the light of increasing world oil prices, decreasing domestic oil production, and social and environmental considerations, Indonesia has

prioritised the development of RE sources and has formulated a set of ambitious targets for the various renewable technologies.

The GOI should be commended for its efforts to shift policy to accelerate the utilisation of RE and to create jobs and generate income by using locally available energy sources. However, the great challenge now is to continue on this route, to give a strong focus to RE implementation and to introduce cost-effective incentives that can attract the necessary investments for achieving the RE targets for 2025.

The IEA Review Team recommends that the Government of Indonesia:

- Upgrade the focus on renewable energy in MEMR, such as by creating a new Directorate General of Energy Efficiency, Conservation and Renewable Energy, with clear lines of communication with other relevant Ministries and entities, and the authority to garner and mobilise the necessary resources.
- Develop a comprehensive policy that aims to create a sustainable biofuels market taking into account economic, environmental and social considerations.
- Stimulate the development of hydropower by implementing a regulatory framework that provides the necessary clarity to investors on issues related to the bidding procedure for new projects, taxation and feed-in tariffs.
- Stimulate the development of geothermal energy by implementing a regulatory framework that provides the necessary clarity to investors on issues related to the bidding procedure for new projects, taxation and feed-in tariffs.
- Accelerate new investment by SMEs in off-grid RE technologies by reducing start-up costs and involving lending institutions, and promoting local manufacturing/ maintenance capability and community awareness.
- Introduce feed-in tariffs for electricity produced by small- and medium-scale RE systems based on the avoided cost as determined by the independent electricity regulatory body, and recover the incremental costs of these RE systems from the electricity consumer rather than from the Government budget.

VII. UPSTREAM OIL AND GAS

OVERVIEW

The Government of Indonesia (GOI) established Indonesia's oil and gas industry on the basis of state ownership of the underground resources. In 1970, it established the national oil and gas company (NOC), Pertamina: as well as being an upstream player and the downstream monopoly, Pertamina was the licensor and regulator of its upstream competitors' activity. Pertamina was one of the first NOCs in the world to introduce the production sharing contract (PSC), and its contract terms were considered among the toughest in the world.

The natural maturing of Indonesia's oil and gas fields, combined with limited investment in recent years and consequent reduced reserve replacement rate, has meant that Indonesia's oil and gas production has been declining. Domestic oil demand and, to a lesser extent, gas demand has been steadily increasing. The supply-demand mismatch has dramatically impacted on Indonesia's oil and gas exports. The oil and gas sector constitutes an important part of the Indonesian economy. The industry contributes about 19% of export earnings and 30% of government revenues. Though significant, this contrasts starkly with 1990, when the oil and gas sector contributed 43% of export earnings and 45% of government revenues.

There is a stark need to attract new investment to Indonesia's upstream oil and gas exploration and production (E&P). The GOI has been pursuing this since 2001 with the implementation of its new Oil and Gas Law No. 22/2001 and its implementing regulations to critically transform its state controlled oil and gas sector into a liberalised open and competitive oil and gas market. Based on data from the upstream oil and gas regulator, BP MIGAS, total investment in the sector reached USD 10.1 billion in 2007, up from USD 9.7 billion in 2006.

However, Review Team discussions pointed to many issues remaining in upstream oil and gas, such as uncertainty over the Domestic Market Obligation and lengthy approval times required for bidding processes and plans of development, overlapping responsibilities between GOI organisations involved in approval and administration in the sector, and the lack of a "one stop" service in the sectoral regulator, BP MIGAS.

RESOURCES AND PRODUCTION

Resource potential

Indonesia still represents a very varied exploration potential. Out of 60 sedimentary basins in Indonesia, 38 are drilled and 22 remain to be drilled. Out of the 38 drilled

basins, there have been discoveries in 23. Out of these 23 basins, there is production from 15.

The bulk of Indonesia's oil and gas reserves are located onshore and offshore in Central Sumatra and Kalimantan. The GOI has placed increased emphasis on developing oil reserves in remote locations, such as West Papua, where proven and potential reserves are estimated at 109.1 million barrels.

According to the Directorate General for Oil and Gas (DGO&G), MEMR, the total oil and gas resource (including undiscovered resources) in 2007 was 86.9 billion barrels of oil (BBO) and 385 Tera cubic feet of gas (TCF). Other MEMR sources advised that this data was respectively 56.6 BBO and 334.5 TCF in 2007. Discussions highlighted that there have been some significant changes in MEMR resource estimates from year to year and this was also evident in reserves data.

In order to have effective oil and gas exploration policy that will meet Indonesia's goals for oil and gas production, it is important for Indonesia's authorities to have good and consistent estimates of the oil and gas resource. The large degree of inconsistency in the estimates of Indonesia's resources for some years and between areas within the MEMR likely indicates that current estimates do not have a consistent and robust methodology or that the estimates have not undergone quality control. Large changes in resource estimates from year to year should be explained. There are many institutions around the world (*e.g.* the Norwegian Petroleum Directorate, the United States Geological Survey) that have good experience with establishing systems for resource estimation.

Reserves

For 2007, Indonesia's proven and potential reserves of oil and gas were about 8.4 billion barrels of oil and 180 TCF gas. For oil, this is a decline of 14% since the high in 2001. At today's rates of oil production of around one million barrels per day, Indonesia's current oil reserves have a life of about 24 years.

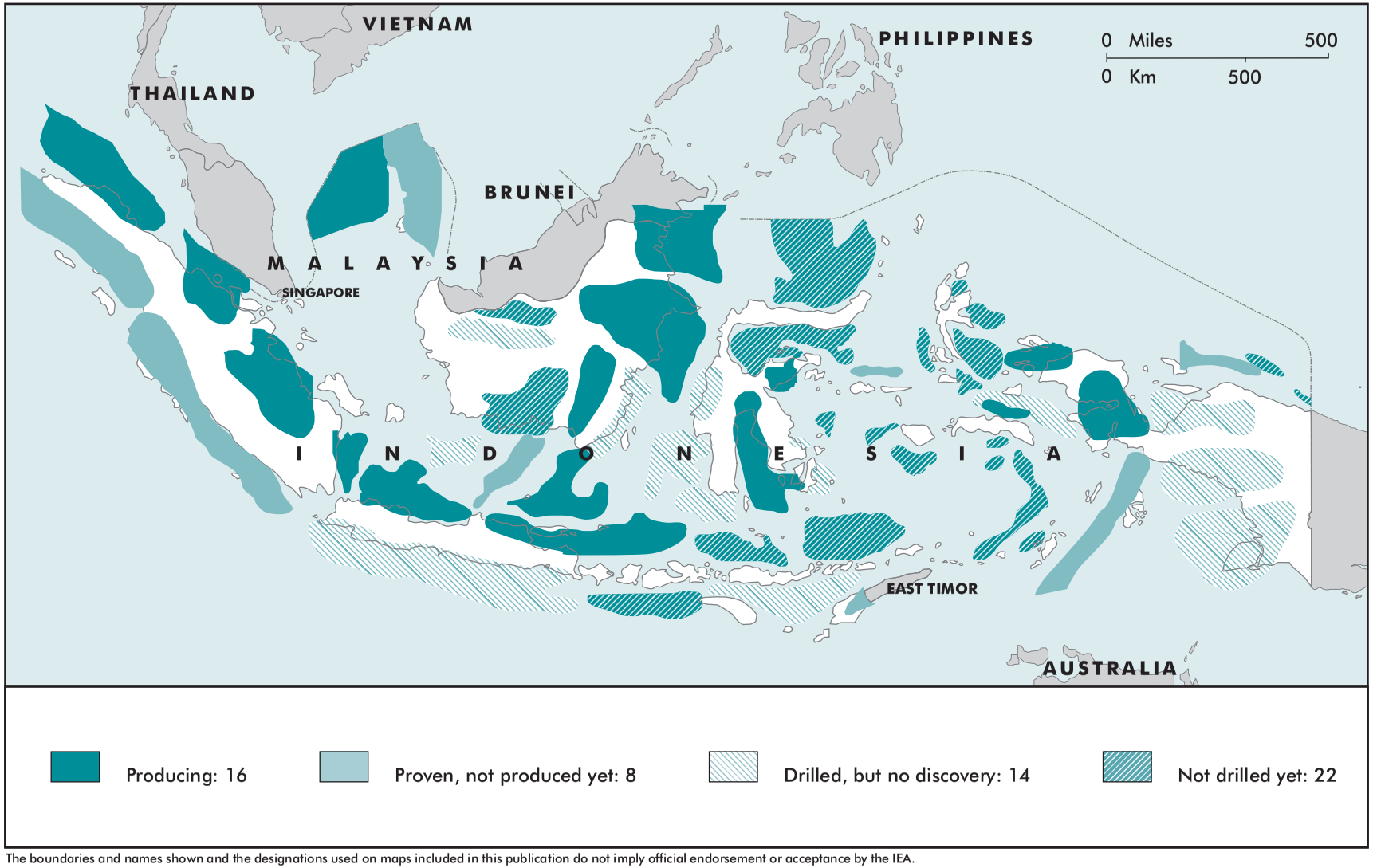
Table 7.1 ..... Estimated oil reserves in Indonesia, at 1 Jan (billion barrels)

	1990	1995	2000	2001	2002	2003	2004	2005	2006	2007
Proven	5.10	4.98	5.12	5.10	4.72	4.73	4.30	4.19	4.37	3.98
Potential	5.80	4.13	4.49	4.65	5.03	4.40	4.31	4.44	4.56	4.41
Total	10.90	11.00	9.61	9.75	9.75	9.13	8.61	8.63	8.93	8.40

Source: Ministry of Energy and Mineral Resources.

Natural gas reserves are more or less at the same level as in 2001, but, again, there is considerable variation in recent year on year data. Indonesia is the tenth largest holder of proven natural gas reserves in the world and the single largest in the Asia-Pacific region.

Figure 7.1 ..... Sedimentary basins of Indonesia



The boundaries and names shown and the designations used on maps included in this publication do not imply official endorsement or acceptance by the IEA.

Source: Ministry of Energy and Mineral Resources.

Table 7.2 ..... Estimated gas reserves in Indonesia, at 1 Jan. (tera cubic feet)

	1990	1995	2000	2001	2002	2003	2004	2005	2006	2007
Proven	67.50	72.26	94.75	92.10	90.30	91.17	97.81	97.26	94.00	106.01
Potential	27.70	51.31	75.56	76.05	86.29	86.96	90.53	88.54	93.10	58.99
Total	95.20	123.57	170.53	168.15	176.59	178.13	188.34	185.80	187.10	165.00

Source: Ministry of Energy and Mineral Resources.

Exploration and production

Indonesian oil production reached its first peak in 1977 at approximately 1.6 million barrels per day, rising from 500 000 barrels per day in a 10 year period. That sharp production growth was attributed to the numerous discoveries and developments made in Indonesia's primary producing basins.

Production reached its second peak in 1994, again at just over 1.6 million barrels per day. This second peak was mainly attributed to the application of new technology, production optimisation, and new field development. Since then, production has steadily declined and, in 2007, production was under a million barrels per day, approximately a 40% decline. The decline since 2000 has been even steeper at 33% over the last 7 years. Almost all oil producers reported continuing production declines, resulting primarily from the mature status of existing oil fields.

Various exploration projects are underway but, to date, these projects have not brought sufficient resources on-stream to replace the declining production of mature fields. The GOI has introduced policies aimed at increasing investment interest but recent bidding rounds resulted in the majority of tenders being won by smaller Indonesian companies and exploration rates have been declining.

The drop in oil production combined with Indonesia's sharp increase in domestic oil demand is one of the main challenges for MEMR. In 2004, Indonesia became a net oil importer. As part of its Energy Blueprint, Indonesia renewed its intention to achieve a production target of 1.3 million barrel per day by 2009. 2007 forecasts by DGO&G showed oil production peaking at between 1.1 (pessimistic)-1.4 (optimistic) million barrels per day in 2010-2011 before beginning, once again, a declining production trend.

This target is ambitious but the Executive Agency for Upstream Oil and Gas Business Activities (BP MIGAS) believes that new production from several existing PSCs will reverse the current decline. In particular, BP MIGAS cites additional short term production from Pertamina (Salawati), PetroChina (Jabung and Sukowati) and Total Indonesie (Peciko). In the medium term, the country expects production from ExxonMobil (Cepu) and Santos (Jeruk). However, production continued its decline into 2007.

An issue that was watched closely by the investment community was the protracted dispute and negotiations by ExxonMobil with state-owned Pertamina over the management of operation of the Cepu field. After several years of negotiations, a Joint Operation Agreement (JOA) was agreed in March 2006 and the project is due to begin production in 2008.

Table 7.3 ..... Exploration and production trends

	2000	2001	2002	2003	2004	2005	2006	2007
Exploration wells	82	106	88	64	71	68	82	57
Oil production (million barrels/day)	1.418	1.341	1.249	1.147	1.094	1.062	1.006	0.954
Gas production (BCF/day)	7.949	7.691	8.334	8.645	8.302	8.179	8.093	7.686

Source: Ministry of Energy and Mineral Resources.

The natural gas production picture is facing similar field maturation and slower than expected reserves replacement. Indonesia is the eighth largest natural gas producing country globally. In 1996 and 1997, gas production reached a peak rate of around 8.7 billion cubic feet (BCF) per day, including losses and own use volumes. It later peaked at 8.6 BCF per day in 2003 but has since declined to 7.7 BCF per day in 2007 and is expected to continue to decline until the Tangguh LNG development comes on stream.

Indonesia's gas is consumed domestically, and is exported as LNG to north Asia and, more recently, as piped gas to Singapore. Indonesia produces LNG from two terminals: the Total Indonesie operated Bontang facility (22.59 MTPA LNG) in East Kalimantan and the ExxonMobil operated Arun plant (6.8 MTPA LNG) in North Sumatra. Until 2006, Indonesia was the world's largest LNG exporter and had been so for 22 years.

However, mirroring the problems in upstream oil production, Indonesia's gas production has declined in recent years and this has impacted on its LNG exports. From its peak export of 26 million tonnes in 2003, it has since declined to 22 million tonnes in 2006. Pertamina, as Indonesia's LNG marketer, has had to reschedule and reduce Indonesia's long-term LNG contract obligations to foreign buyers since 2005.

Arun contracts are due for completion between 2007 and 2014, and Bontang contracts are due for completion between 2011 and 2018. The likelihood of renewal of all these contracts is unclear: in the new Oil and Gas Law No. 22/2001, the GOI has explicitly stated that the domestic market has priority for Indonesia's gas production, and producers have a Domestic Market Obligation (DMO) to sell 25% of their production into the domestic market. Under the Energy Blueprint (Presidential Regulation No. 5/2006), gas is also to increase its share of the domestic energy mix from 27% in 2006 to 30% by 2025. DGO&G undertook a 'Natural Gas Balance, 2007-2015' to better evaluate the remaining gas that will be available for export, and contracts are under negotiation.

A new gas development due for commissioning in late 2008, the BP operated Tangguh LNG development (7.8 MTPA LNG) in West Papua, has secured long-term export

contracts. Production from a possible third train of 3.8 MTPA may be destined for a domestic LNG regasification terminal in West Java around 2014.

In February 2008, the GOI advised that Pertamina was to take over the development of Indonesia's massive Natuna D-Alpha gas field in the South China Sea from the former PSC developer, Exxon Mobil. The block contains some 222 TCF of gas with a very high CO_2 content of 70%; as a consequence, the field's development is some way off.

Indonesia's oil and gas resource potential remains promising but issues such as the Domestic Market Obligation, domestic pricing and investment climate uncertainties are impacting on exploration and development.

MARKET LIBERALISATION AND REGULATION

Pertamina

After independence from Holland, the new GOI established the oil industry on the basis of state ownership of the underground resources. The GOI increased its control over the oil sector during the 1950s and 1960s by increasing operations of several state-owned oil companies and by stiffening the terms of contracts with foreign oil firms.

PT Pertamina (Persero) is the Indonesian state-owned national oil and gas company (NOC) and it was established in 1968 as a result of a merger of three state-owned companies (the Indonesian Oil Mining company (Pertamin), the National Oil Mining Company (Permina), and the National Oil and Gas Company (Permigan).

The law establishing Pertamina (Law No. 8/1971) was announced two years later, and Pertamina's duties and responsibilities included licensing and contracting with other operators. This made Pertamina both a player and the regulator. Pertamina was one of the first in the world to introduce a new form of contract, the production sharing contract (PSC): this split "profit" oil production between the contractor and the GOI, represented by Pertamina, and allowed the GOI to assume ownership of structures and equipment used for exploration and production within Indonesia. Pertamina's control over allowable costs, and its insistence on "ring fencing" of production areas, were industry firsts. Indonesia's contract terms were considered among the toughest in the world, with the GOI in most cases receiving 85% of oil produced after the foreign company recovered costs. For many years, Pertamina used the variation in profit oil shares as its main method of attracting the desired mix of new contractors.

Oil and Gas Law No. 22/2001

The major reform of Indonesia's oil and gas upstream and downstream sectors came with the introduction of the new Oil and Gas Law No. 22/2001, which replaced the Oil and Gas Law of 1960 and the Law for Pertamina No. 8/1971. The liberalisation of Indonesia's oil and gas sector had been under discussion for many years. Under the new Oil and Gas Law, Pertamina had to give up its position of being both a player

and a licensor of new oil development licenses/regulator of its competitors' activities. It also greatly reduced the company's monopoly in upstream field development. Its upstream and downstream regulatory and administrative functions were respectively transferred to new regulatory bodies, BP MIGAS and BPH MIGAS.

In 2003, Governmental Regulation No. 31 of 2003 converted Pertamina into a limited liability public company. Pertamina is today in the process of setting up a range of subsidiaries to handle different parts of the companies upstream oil and gas business in Indonesia and in new activities in Libya, Iraq and Malaysia.

Although a state-owned company, Pertamina's oil production is still relatively modest at around 110 000 barrels oil equivalent per day or about 10% of the total production of Indonesia. This production does, however, place it as the second largest producer of oil and the third largest producer of gas in Indonesia. With regards to reserves, they are by far the largest company in Indonesia, especially with regard to gas reserves.

During the Review discussions, there were contradictory messages regarding to what extent Pertamina receives preferential treatment in obtaining acreage in Indonesia. Pertamina stated that it has the right to ask for any area for a new PSC and it will receive it without competition at a fixed GOI/contractor spilt. DGO&G advised that such preferential treatment did not exist. In early 2008, it was announced that Pertamina would have the option over 15% of each of the PSCs awarded in the upcoming bidding round, provided that it paid its proportional share of all expenses in the PSC.

Sectoral policy and regulation

Directorate General of Oil and Gas, MEMR

The Government's key policy and planning institution for Indonesia's upstream oil and gas sector is the Directorate General for Oil and Gas (DGO&G), under the Ministry of Energy and Mineral Resources (MEMR). DGO&G is the executive body responsible for sectoral planning, policy, and industry development for oil and gas upstream and downstream, including promulgating regulations.

DGO&G is also responsible for the preparation, management and awarding of acreage bidding rounds. DGO&G is made up of four Directorates and a Secretariat:

- Directorate for Upstream Business Development.
- Directorate for Downstream Business Development.
- Directorate for Programme Development.
- Directorate for Technical and Environmental Regulation.
- Secretariat of Directorate General.

BP MIGAS

As required by the new Oil and Gas Law, the GOI established the Executive Agency for Upstream Oil and Gas Business Activities (Badan Pelaksana Minyak dan Gas Bumi – BP MIGAS) under Governmental Regulation No 42/2002. It commenced operations in July 2002, taking over Pertamina's upstream regulatory function and management of oil and gas contractors. However, it lacked implementing regulations

until 2004 when the GOI issued Governmental Regulation No. 35/2004 under the new Oil and Gas Law.

BP MIGAS is responsible for upstream oil and gas activity from the time of signing of a PSC and through the lifespan of those PSCs. The responsibilities are manifold and includes:

- Providing recommendations for MEMR/DGO&G regarding its policies to prepare and offer working acreage and PSCs;
- Signing PSCs;
- Evaluating and approve plans for development;
- Approving work programmes and budgets;
- Monitoring the operation of PSCs; and
- Appointing sellers of Indonesia's share of oil and/or natural gas.

BP MIGAS is led by a chairman that is appointed by the President, based on the recommendation of the Minister of Energy and Mineral Resources after approval by the House of Representatives (DPR). The Chairman must periodically report to the President (every six months or as requested), via the Minister of Energy and Mineral Resources. The agency must also report and gives copies of signed PSCs to the DPR.

During the Review discussions, the division of some policy responsibilities and work of the Directorate General of Oil and Gas (DGO&G) and the upstream regulator, BP MIGAS, was confused and appeared to overlap. The Review Team found, as with other government institutions involved in the energy sector, that there is a very strong need to clarify and make transparent for each institution, its role, its authority, and its line of reporting.

Clarifying the upstream oil and gas sector legal framework

Upstream oil and gas companies in Indonesia are subject to a large number of laws, regulations, permits, and decrees, and these instruments are under the jurisdiction of a number of different ministries, directorates and other government institutions. For both new entrants and existing players in Indonesia's upstream sector, this makes for a legal framework that is complex and arduous and appears poorly co-ordinated and overlapping across government institutions.

The introduction of a large number of regulations combined with changes to the standards in the PSCs and in upstream sector regulation has also led to inconsistencies and conflicts between some regulations. This particularly seems to be the case regarding the tax law and some of the terms and conditions in the old type PSCs.

In the Review discussions with oil and gas companies in Indonesia, there was also clearly a need for clarification of regulations and their application, such as with the Domestic Market Obligation for gas and uncertainty over taxation requirements for operators. There was also a strongly expressed need for reducing the multi-stop approval processes and periods for bidding for the Plans of Development and for the authorisation of expenditure. This appears to particularly relate to approval and administrations processes within BP MIGAS.

A further complicating and little understood area for oil and gas companies is the role and authority of local Governments over issues affecting upstream sector projects.

There is a very strong need for a full review of all the legal instruments and their implementing institutions that impact on the oil and gas upstream industry, with the goal of removing conflicts and harmonising and simplifying the legal framework and its application. The review should be done in close co-operation with the industry and should include a mechanism for both implementing the review recommendations and for monitoring their success.

Companies active in Indonesia

In Indonesia, all the largest international oil and gas companies (IOGC) are represented. The IOGCs of Chevron, TOTAL, BP, Conoco Phillips, and ExxonMobil dominate the list of both the largest producers and the companies with the largest reserves. In addition to the super majors, the state-owned Pertamina, the Japanese company INPEX, China's state-owned companies CNOOC and PetroChina, the Indonesian company MEDCO, and the Canadian company Talisman has substantial reserves and/or production in Indonesia. Pertamina strongly dominates the oil and gas reserves holding.

There are also a large number of other smaller and medium sized IOGC and a number of local Indonesian companies in addition, but they represent a very modest contribution to total production in Indonesia. Many of these smaller companies have, however, signed a number of PSCs during the last couple of years.

EXPLORATION

Bidding rounds

Exploration acreage in Indonesia can be obtained from the State in two ways: normal bidding rounds and direct tenders. Both processes are administered by DGO&G on behalf of MEMR.

Normal tender

A normal bidding round begins with the Minister determining the acreage that should be included in the round and the terms and conditions for the PSCs and the bid documents. DGO&G is responsible for this preparation and will also have contact with other government institutions regarding environmental issues and relevant local issues. There is co-operation between DGO&G and BP MIGAS in preparing a bidding round.

The announcement of a bidding round is made public through the DGO&G website and other media. DGO&G will usually also arrange a "road show" in selected cities around the world to promote the upcoming bidding round. It is compulsory for the

companies to purchase an official government data package with seismic data. The time from announcement to the deadline for the application is 120 days.

The bids received are evaluated by an evaluation team. The evaluation is based on:

- Technical evaluation (primary weighting):
- Seismic survey commitment; and
- Commitment of number and location of proposed wells, based on G&G evaluation and technical justification supported by appropriate data.

- Financial evaluation (secondary weighting):
- Signature bonus; and
- Financial ability to support work programme of firm commitment activity during the first 3 years. The financial ability needs to be supported by annual financial report or bank reference.

- Performance evaluation (least weighting):
- Experience in the oil and gas business; and
- Compliance with provisions and regulations for oil and gas activity.

Based on the evaluation of this team, the Director General of DGO&G appoints the winning bidder. BP MIGAS signs the PSC with the winning bidder, and the terms in the winning bid are made public. DGO&G is aiming at arranging annual bidding rounds.

Direct offers

Exploration acreage can also be obtained from the GOI through a relatively new system of direct offers. Under this system, companies can approach the authorities with a direct offer for a specific area. The authorities will then undertake a joint study with the company making the direct offer and will then decide if the area can be awarded. If so, the area will be announced as in a normal bidding round and other interested companies will have 45 days to submit an application. Applicants have to buy a data package from the authorities. Applications will be evaluated as in a normal bidding round.

If there are no other interested parties, the area will be awarded to the company that made the direct offer, provided that their bid meets the minimum criteria set by the authorities. If there are other bids and the bid of the company that initiated the process is not the best bid, this company will have an opportunity to match the "winning" bid. The PSC will then be signed between the winning company and BP MIGAS.

Bid evaluation

Several of the criteria by which bids under both processes are evaluated can be difficult to evaluate in an objective manner. As presented in the Review discussions, most weight is put on the technical evaluation ("prefer oil and gas than cash"). However, it is difficult to understand how these weights work in practice and how the technical evaluation is done.

Local content is one of the criteria by which bids are evaluated. However, an overdue emphasis on local content can create obstacles to obtaining the best possible

international technology, equipment and people at the best possible price. In a high risk and technology intensive industry, such as the oil and gas upstream business, it is especially important that companies winning a tender have a proven track record and the best technology at hand. It is therefore important to use a criteria emphasising local content with caution and with flexibility.

Indonesia needs to strengthen its service industries in the upstream oil and gas sector, and international experience has shown that this is not necessarily achieved by protecting a national industry through a requirement for local content. Additionally, for companies considering investment, high levels of local content requirement may be considered a cost impost.

Exploration activity and blocks awarded

By late 2007, the GOI had signed 16 new PSCs, compared to 5 in 2006, 10 in 2005, 16 in 2004, and 15 in 2003. The winners in recent bid rounds have been dominated by smaller local companies. The last regular tender of 2006 resulted in 12 areas being awarded with commitments of a total of USD 12 915 million in geological and geophysical (G&G) studies, 8 560 kilometres 2D Seismic, 5 500 square kilometres 3D seismic, and 22 wells. The total signature bonus for the 12 areas was USD 30.09 million.

In addition to the awards of new PSCs, there have been two awards of service contracts and 8 amendments/extensions to existing PSCs in the last five years. After some years with a rather low seismic activity in Indonesia, the amount of 3D-seismic being gathered is increasing rapidly. Most oil exploration is currently being carried out in the basins of western Indonesia.

Table 7.4 ..... 3D Seismic gathered in Indonesia

	2004	2005	2006	2007
Offshore	0	9 904	5 205	4 992
Onshore	772	1 625	1 008	7 783
Total	772	11 529	6 213	12 775

Source: Ministry of Energy and Mineral Resources.

With regard to exploration wells being drilled, the picture is not as bright as for 3D seismic. The number of exploration wells drilled in recent years is substantially lower than around the turn of the millennium due mainly to a decline in exploration drilling offshore. More challenging, however, is that the success rate has also been falling since the turn of the millennium. The success rates below are technical success rates and does not say anything about how many of the discoveries proved commercial.

Table 7.5 ..... Number of exploration wells

	2000	2001	2002	2003	2004	2005	2006
Offshore	53	49	43	25	28	19	31
Onshore	29	57	45	39	43	49	33
Total	82	106	88	64	71	68	64
Discovery	44	55	46	15	26	30	23
Success ratio	54%	52%	52%	23%	37%	44%	36%

Source: Ministry of Energy and Mineral Resources.

Exploration policy

Providing practical incentive to companies to encourage their investment in oil and gas exploration is a serious challenge for Indonesia. The system of planned annual bidding rounds and direct offers is an important change to encourage increased exploration activities.

The GOI has just recently made important changes to the exploration commitments in the PSC. Previously the contractor committed themselves to six years of exploration that included general G&G-work, seismic, and drilling. The contractors had to establish a bank account to hold performance deposits that the GOI had the right to confiscate should they not meet the drilling obligation.

The new system commits the companies to a three year exploration programme that includes G&G-work and seismic. If the seismic interpretation does not give cause for drilling in the awarded area, the concession can be handed back to the state without any penalty apart from the signature bonus already paid. This change improves companies' willingness to enter into PSCs in Indonesia, by reducing their exploration risk and unnecessary expenditure.

A further incentive to exploration by companies is to reduce the up-front non-deductible costs incurred by a company prior to its signing on to a PSC. Generally a company has to gather more seismic information to evaluate a prospective acreage than the information provided in the official government data package.

This lack of seismic coverage is also an issue for DGO&G geological understanding of the Indonesia oil and gas resource potential. As there is a legal requirement in Indonesia for all seismic data to be reported to the GOI, the diligent collection and maintenance of this data would be of direct benefit to the GOI. Its subsequent provision at low cost to prospective acreage bidders would also encourage exploration interest.

PRODUCTION CONTRACTS

Participation in Indonesia's upstream sector is possible only after signing a contract with BP MIGAS. These contracts are co-operation contracts and are generally either

Production Sharing Contracts (PSC) or Technical Service Contracts (TSC). There are some other contracts, such as the Enhanced Oil Recovery Contract which are essentially an extension of a PSC.

Production Sharing Contracts (PSC)

The Production Sharing Contract is a co-operation contract between BP MIGAS and a private investor (which includes foreign and domestic companies, as well as Pertamina). BP MIGAS is the supervisor or manager of the PSC. Investors are participating interest holders and contractors. The GOI and the contractor take their split of the oil and gas production revenue, based on the PSC agreed percentages. Operating costs are recovered from production through contractor cost oil as defined by the PSC. The title of the hydrocarbon passes to the contractor at the export or delivery point.

The maximum duration of a PSC is 30 years, including a 6-10 year exploration phase. During the exploration phase there are set rules for relinquishment of the PSC. The contract can be extended for another 10 years. To obtain an extension, the contractor has to apply 2 years before termination of the PSC and renegotiate the conditions with BP MIGAS.

Today the standard share for a contractor in a PSC is between 20-35% for oil and 30-40% for gas. Previously the contractor share was typically 15% for oil and 30% for gas. The GOI also set a first tranche petroleum (FTP) obligation of normally 10% which goes solely to the GOI. The increase in the contractor share came in the 2005 bidding round as a response to what the authorities saw as a lack of exploration activity. In 2005, under MEMR Regulation No. 8/2005, contractors developing marginal fields were given an extra 20% reimbursement in costs recovery. In a PSC, all expenses related to the acreage in question are cost deductible. All costs do, however, need to be approved by BP MIGAS if they are to be deductible.

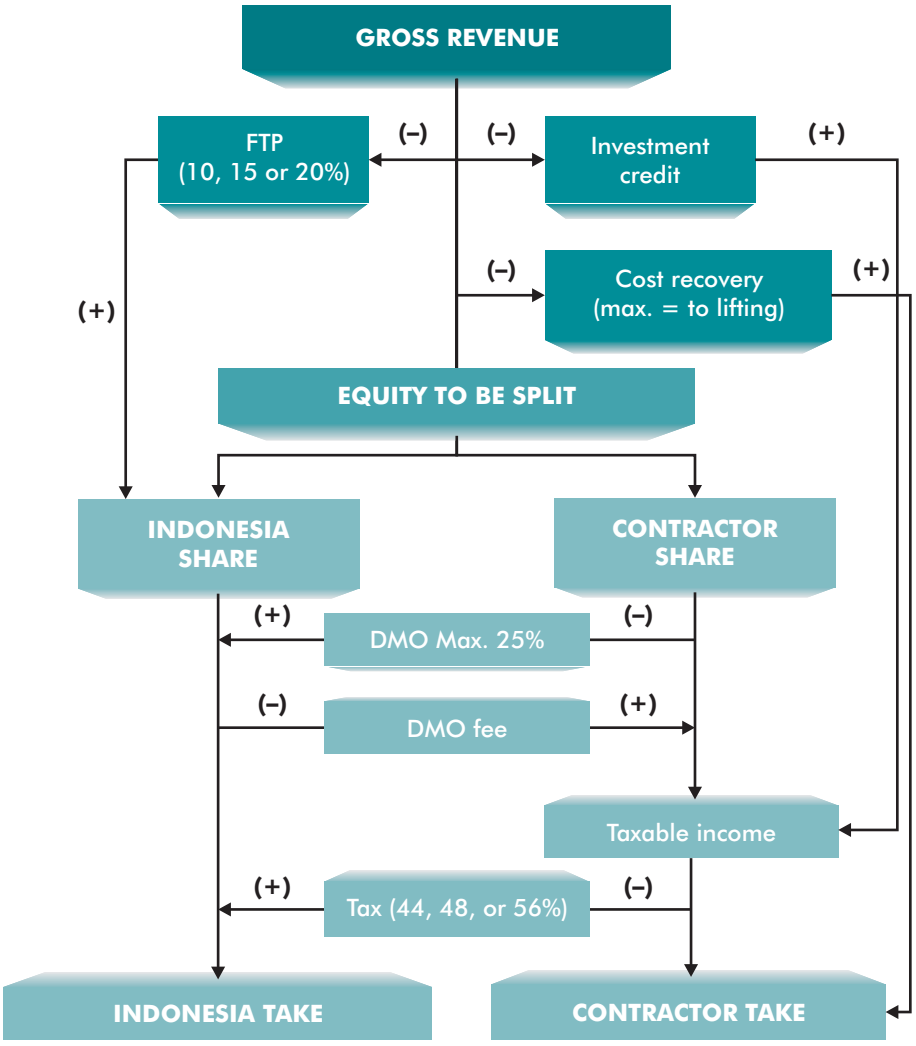
The IEA Review Team would like to underline that although it is important to make sure that the total government take (TGT) is at a competitive level, it's equally important for Indonesia to work on improving the transparency, effectiveness and predictability in the framework conditions for oil and gas companies doing business in Indonesia.

As discussed in the preceding section, 'Clarifying the upstream oil and gas sector legal framework', there are several generations of PSCs in Indonesia. According to companies active in Indonesia, there is a problem with the present laws and regulations not being consistent across the generations of PSCs. In Indonesia's increasingly marginal E&P environment of small reserve accumulations and high infrastructure costs, there is a need to both minimise the cost of entry into the upstream sector and to better balance the E&P risks and rewards.

As was identified by several different institutions, attracting foreign investment to Indonesia has provided access to technology, expertise and experience. This is especially important in Indonesia's oil and gas upstream where mature fields and frontier areas are becoming more technically challenging. Hence, it is important to

ensure that Indonesia's framework conditions do not present unnecessary obstacles. The current taxes and value added tax (VAT) on equipment imports were cited as punitive examples.

Figure 7.2 ..... Revenues flow in a Production Sharing Contract



Source: Ministry of Energy and Mineral Resources.

The new Oil and Gas Law also introduced a Domestic Market Obligation (DMO) for oil and gas, and a degree of uncertainty still surrounds the future policy for the DMO and its practical enforcement and pricing conditions. For example, in the Law the DMO can be up to 25% of production, while the Constitutional court in 2004 stated that the DMO should be equal to 25%.

It is also uncertain as to the price that companies will receive for oil and gas required under the DMO. The GOI is actively encouraging domestic gas use but Indonesia's domestic gas prices are at least a third less than international prices. The uncertainty

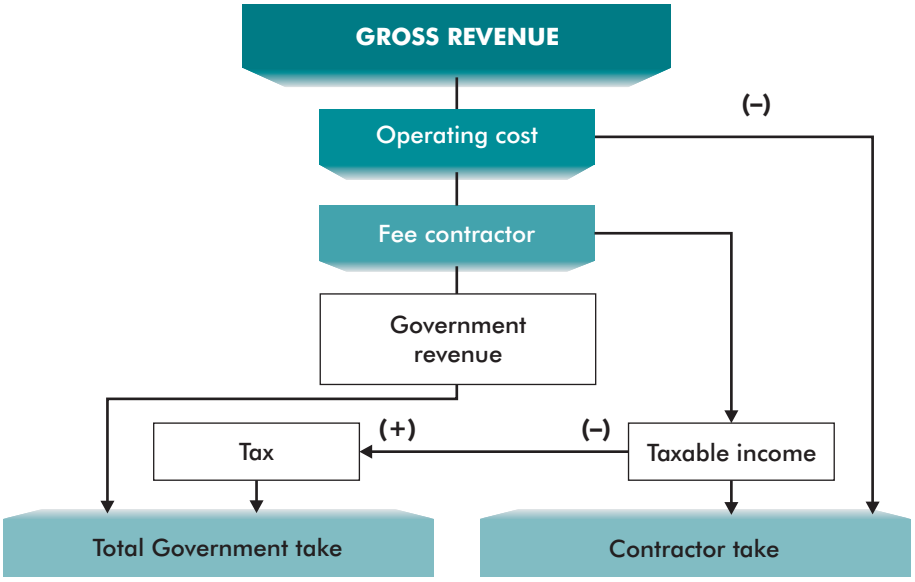
connected with the DMO also influences the predictability and risk connected with doing business in Indonesia.

The first 5 years of production are exempted from the DMO. This combined with the fact that the authorities do not approve gas production rates can give companies the incentive to manage the reservoir in a way that is not in Indonesia's long-term interest.

Technical Assistance Contract

Another variation of a co-operating contract is the Technical Assistance Contract (TAC). TACs are typically used for established production areas and therefore usually only cover exploitation. BP MIGAS is the supervisor and manager of the TAC.

Figure 7.3 ..... Revenues flow in a Technical Assistance Contract



Source: Ministry of Energy and Mineral Resources.

Typically, the contractor does not share in production, and, under the new Oil and Gas Law, existing TACs will not be extended. In the last five years, only one new TAC has been awarded.

Enhanced oil recovery contract

The Enhanced Oil Recovery Contract is a version of a PSC, and is typically used for established producing fields with the intent of applying advanced technology to increase the recovery of hydrocarbons. BP MIGAS is the supervisor and manager of the EOR Contract. With EOR contracts, the GOI has flexibility to renegotiate terms and thereby give incentives to owners of producing fields to increase the recovery.

Plan of Development

When a discovery has been made and before production can start, the licensee is required to have a Plan of Development (POD) approved by BP MIGAS. The number of PODs being approved has been increasing over recent years, with 33 being submitted in 2006 covering a total of 1 085 million barrels of oil and 7.19 TCF of gas.

Conclusions and recommendations

The Review discussions highlighted the challenges that the GOI has already identified, namely the need for more foreign investment and increased exploration activity to offset the decline in production.

The introduction of the new Oil and Gas Law No. 22/2001 introduced very important new principles for good governance and creating a predictable, transparent and open industry in the upstream sector. However, there remain some challenges to its implementation and to creating the predictability and transparency on which investors can base their long-term investment and business decisions.

The IEA Review Team recommends that the Government of Indonesia:

- Improve Indonesia's oil and gas resource estimates and the methodology being used to determine them, and that those resource estimates provide the foundation for the exploration policy of MEMR.
- Consider removing all preferential treatment for Pertamina so as to create a level playing field for current and prospective players and to ensure Pertamina is best developed for an open and competitive market.
- Clarify and clearly separate the responsibilities and work programmes of the Directorate General of Oil and Gas (DGO&G) and the upstream regulator, BP MIGAS, with particular focus on operational management to prevent duplication. Merge their line of reporting to ensure better co-ordination and co-operation between the two institutions.
- Undertake a full review of all laws, regulations, permits, and decrees impacting on upstream business in Indonesia in order to make the framework conditions for the upstream sector coherent, predictable and transparent and thereby competitive in the international arena:
  - Undertake the review in close co-operation with oil and gas companies operating in Indonesia; and
  - In co-operation with the oil and gas industry, implement an effective system for the prompt implementation and monitoring of the review recommendations.
- Improve the predictability, transparency and objectivity of the bid award process, and consider making public the main parts of each bid application.
- For the evaluation of tender bids, allow a larger degree of cost-benefit analysis to determine local content requirements.
- Review the incentives for attracting greater oil and gas exploration interest with a focus on frontier areas, particularly by reducing the up-front non-deductible costs incurred by a company prior to its entering into a PSC.
- Commensurate with Indonesia's need to attract new investment in upstream oil and gas production, review the imposts and incentives in its PSCs for both mature and frontier acreage.

VIII. OIL DOWNSTREAM

OVERVIEW

Since 2001, Indonesia's downstream oil sector has been undergoing a critical transformation from a state-controlled market to a more liberalised market. In 2001, the Government of Indonesia (GOI) enacted the new Oil and Gas Law No. 22/2001, initiating the removal of the monopoly of Pertamina, the state-owned oil and gas company, over petroleum refining and petroleum product distribution and marketing. The new Law also required the establishment of transparent market pricing and the establishment of a new downstream regulatory authority, BPH MIGAS.

Such transitions are not straightforward: at this time, the implementation of the new Oil and Gas Law has established BPH MIGAS and some companies have entered a limited portion of downstream petroleum distribution and marketing. However, the downstream market still retains a dominant Pertamina presence, there is limited investor interest in entering the refining sector, subsidised petroleum products continue to be marketed, and Pertamina retains its Public Service Obligation (PSO) for the sale of these products.

In 2006, petroleum products provided about 52% of Indonesia's demand for commercial energy. However, under Presidential Decree No. 5/2006, petroleum is targeted to decline to a share of 20% of the optimal energy mix by 2025. This is an ambitious goal; oil's share of Indonesia's commercial energy mix has remained consistently around the 50% mark, and fast developing economies, such as Indonesia, require petroleum products to fuel their thriving transport sectors. Policy and programmes to encourage petroleum conservation, diversification, and development of alternatives is required, but the starting point is implementing the new Oil and Gas Law's market pricing for petroleum products and establishing an effectively competitive downstream market.

MARKET LIBERALISATION AND REGULATION

The GOI has been working to encourage greater capacity, efficiency and market responsiveness in Indonesia's downstream oil sector since 1997. In the early 1990s, the GOI determined that private sector investment was needed to add capacity to Indonesia's petroleum refining industry: under Presidential Decree No. 31/1997, the GOI enabled private companies to build petroleum refineries in Indonesia for the domestic market. However, Pertamina was to remain the monopoly distributor of their products to the domestic market. This Decree did not attract investment.

Oil and Gas Law No. 22/2001

The new Oil and Gas Law No. 22/2001 marked a major step towards eliminating petroleum products subsidies and promoting the establishment of an open and competitive downstream oil sector. It works, amongst other things, to transform Pertamina from a monopoly player and regulator into a state-owned limited liability company in equal competition with new entrant private sector players.

By November 2005, the new Oil and Gas Law had envisaged a downstream sector with local and foreign companies investing in new petroleum refineries, local and foreign companies entering petroleum product transportation/storage/marketing, an independent regulator giving all players equal regulatory and legal treatment, a transparent pricing regime based on market prices, and the cessation of Pertamina's Public Service Obligation (PSO) for the sale of the subsidised products throughout Indonesia.

In recent years, some foreign companies have entered the downstream petroleum distribution and retail market for non-subsidised petroleum products. However, there remains limited investor interest in investing in and operating petroleum refineries in Indonesia, subsidised petroleum product continues to be marketed with prices set by the GOI, and Pertamina has to maintain its PSO.

Market regulation

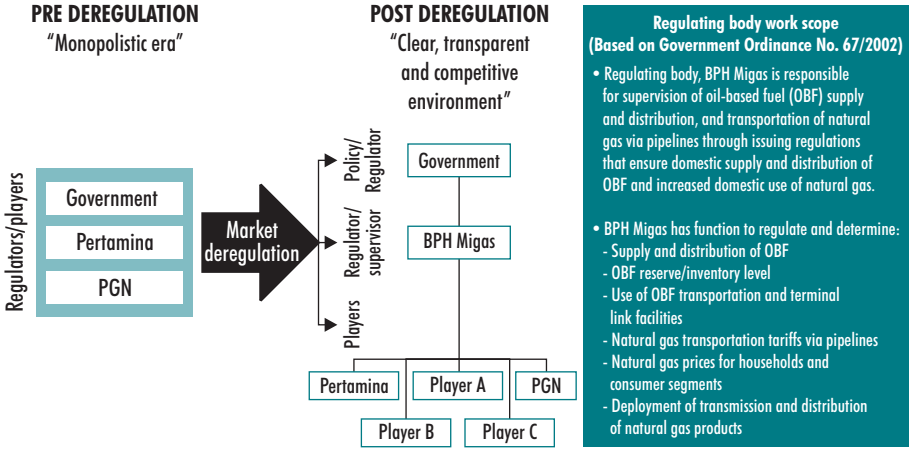
Under the new Oil and Gas Law, downstream business activities may be carried out by a state-owned corporation (*i.e.*, Pertamina), regional administration owned companies, co-operatives, or private business entities after obtaining business licenses from the government. Businesses that engage in downstream activities may not carry out upstream activities (Article 10), and separate business licenses are required for each downstream activity of processing, transmission and distribution, storage, and trading (Article 23).

Indonesia's Regulatory Body for Oil and Gas Downstream, BPH MIGAS, was enacted under the new Oil and Gas Law, and established in 2002 under Governmental Regulation No. 67/2002 to regulate and supervise downstream oil supply and distribution activities. BPH MIGAS is accountable to the President of Indonesia.

However, BPH MIGAS lacked implementing regulations until 2004. Under Governmental Regulation No. 36/2004 (concerning Oil and Gas Downstream Business Activity) and the Ministry of Energy and Mineral Resources Decree No. 7/2005 (regarding Requirements and Guidance on Implementation of Oil and Gas Downstream Business License):

- the Ministry of Energy and Mineral Resources (MEMR) has responsibility for issuing licenses for businesses wishing to engage in downstream activities;
- MEMR will determine types, standard and quality of fuel oil, gas and other fuels that can be marketed domestically;

Figure 8.1 ..... Downstream oil and gas market structure



Source: BPH MIGAS.

- BPH MIGAS will regulate, provide rulings, and supervise the implementation of downstream oil supply and distribution, the national fuel stock, and utilisation of petroleum transport and storage facilities; and
- the GOI sets policy on the national Strategic Fuel Reserve, and can obligate downstream license holders to contribute to the reserve.

More explicitly, BPH MIGAS is responsible for regulation of:

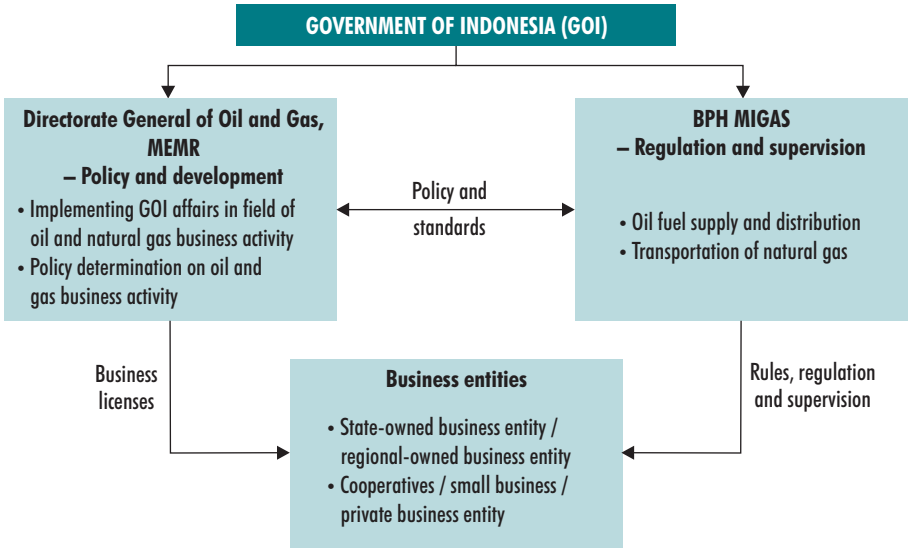
- businesses' supply and distribution of petroleum fuels so that fuel availability is guaranteed throughout Indonesia;
- the allocation of petroleum stock and the trading area for businesses;
- the use of the national petroleum stock during a petroleum scarcity;
- facility sharing in petroleum transportation and storage, including determination of a tariff setting mechanism;
- settlement of disputes associated with petroleum trading operations;
- sanctions of businesses for violation of their obligation for supply and distribution; and
- information system on petroleum supply and distribution.

BPH MIGAS is also responsible for the supervision of prices of subsidised petroleum products, and the depth of its responsibilities recognises the logistical and pricing issues involved in ensuring petroleum availability in Indonesia's remote areas.

BPH MIGAS is also responsible for developing policy and proposals on the above matters for consideration by MEMR.

During the Review Team discussions with officials and with companies, the responsibility and lines of authority for BPH MIGAS in relation to MEMR and other ministries were sometimes unclear. For companies, this creates investor uncertainty and prolongs investment decision making. The Review Team recognises that the regulation of a large and complex oil downstream sector that is in the transition of a major unbundling requires time. However, to enable BPH MIGAS to acquit its role in this transition, attention is required to clarify these issues.

Figure 8.2 ..... Downstream oil and gas market regulation and supervision



DOMESTIC DEMAND

Indonesia's finished petroleum product demand is primarily for transport fuels, kerosene for household cooking and lighting, and fuel oil, industrial diesel oil, and automotive diesel oil for industry and power generation. From year 2000 to 2004 (*i.e.* subsequent to the Asian financial crisis but prior to the uncapping of fuel prices for Indonesia's industry consumers and prior to the 1 October 2005 major increase in Indonesia's subsidised fuel prices), average annual growth in Indonesia's petroleum product demand was about 3.5% per year. Except for fuel oil and industrial diesel oil, all categories of fuel demand increased. A significant part of the increase was the result of smuggling of Indonesia's subsidised petroleum fuels to neighbouring countries, and the adulteration of more expensive fuels with the highly subsidised kerosene.

Table 8.1 ..... Domestic petroleum products sales (thousand kilolitres)

	2000	2001	2002	2003	2004	2005	2006	2007
Automotive Diesel Oil (ADO)	22 072	23 360	24 213	24 064	26 488	27 056	25 013	26 119
Gasoline	12 429	13 096	13 732	14 647	16 418	17 480	17 662	18 790
Kerosene	12 458	12 283	11 678	11 753	11 846	11 386	10 025	9 898
Fuel Oil (FO)	6 076	6 162	6 260	6 216	5 755	4 734	4 976	5 135
Industrial Diesel Oil (IDO)	1 472	1 427	1 360	1 183	1 093	890	487	269
Avtur	1 349	1 385	1 597	1 929	2 438	2 323	2 505	2 248
Avgas	5	6	3	4	3	3	3	2
Total	55 861	57 719	58 845	59 797	64 041	63 872	60 671	62 461
Total excl. FO, IDO	48 313	50 130	51 225	52 398	57 193	58 248	55 208	57 057

Source: Ministry of Energy and Mineral Resources.

The retail price of petroleum products on the domestic market, excluding high-grade transport fuels and fuels sold to industry and the power sector, is determined by the GOI. The subsidised fuels are "Premium" gasoline (88 octane) and automotive diesel oil (ADO) used in transport (the largest subsidised market), and kerosene used by households. Subsidised fuels can be used only for transport, households, certain types of fishing boats, and public service facilities. This is further discussed in the following Pricing and Subsidies section.

Beginning July 2005, prices for fuel sales to industry were adjusted according to international market prices and are managed by Pertamina and recent new entrants to the petroleum retailing market. Non-subsidised (high grade) automotive fuels were also introduced. On 1 October 2005, in response to the continuing need to reduce the cost of the petroleum subsidy to the national budget, the GOI also instituted a major retail price increase (average of 125%) of Indonesia's subsidised petroleum products. As a consequence, petroleum product demand over 2005 and 2006 declined by 2.6% per year in this otherwise fast growing economy: as well as dampening overall demand, the dramatic increase in relative prices partially reduced the incentive for smuggling of subsidised petroleum products to Indonesia's neighbours.

Kerosene demand declined by 15% from 2004 to 2006. Industry's petroleum demand, now exposed to international product price movement, declined by 27% over the two years. Some industry would have diversified into natural gas consumption in stationary applications.

Table 8.2 ..... Domestic petroleum products sales by sector, 2004 vs. 2006

	2004		2006	
	thousand kL	**% share**	**thousand kL**	**% share**
Industry	13 495	21.1	9 850	16.2
Households	11 787	18.4	9 970	16.4
Transport	31 962	49.9	31 350	51.6
Power plants	6 797	10.6	9 530	15.7
Total	64 041		60 700	

Source: Ministry of Energy and Mineral Resources.

IMPORTS

In 2004, Indonesia became a net importer of crude oil and petroleum products. The gross output of finished petroleum products of Indonesia's nine petroleum refineries has remained at around 41-45 million kL since 2000, while domestic demand has grown from 56 million kL in 2000 to 60+ million kL currently. Indonesia's stagnant refinery sector versus its growing domestic petroleum demand means that Indonesia must increasingly import finished petroleum products. In an environment of partially subsidised domestic pricing, this has major budgetary implications.

Table 8.3 ..... Domestic petroleum products imports vs. exports

	Imports		Exports	
	thousand kL	% increase	thousand kL	% increase
2001	14 174		8 763	
2002	16 940	19.5	8 822	0.7
2003	17 058	0.7	10 129	14.8
2004	24 398	44.0	10 255	1.2
2005	26 456	55.1	6 866	-33.0
2006	22 454	-7.97	5 955	-13.3

Source: Ministry of Energy and Mineral Resources.

Indonesia's dependence on imported finished petroleum products has grown from 29% in 2002 to about 35% in 2006. This condition makes Indonesia more vulnerable to the price fluctuations for oil products in the international market and exacerbates the budgetary impact of funding its petroleum products subsidies.

The products import slate is transport fuels, primarily ADO and increasing amounts of high specification gasoline to feed the growing new vehicle fleet. Indonesia's exports of petroleum product are limited to fuel oil and other refinery products, primarily naphtha.

PETROLEUM REFINING

Current petroleum refining capacity

Indonesia has nine petroleum refineries, all owned and operated by Pertamina. They have a combined installed capacity of 1.06 million barrels per day (see below). Since 2000, they have maintained a combined output of finished petroleum products and non-fuels of around 950 thousand barrels per day (bpd), with an average crude oil and other feedstocks input for the period of around 985 thousand bpd. This translates into a very reasonable daily operating capacity of around 93% since 2000. The refineries are, however, only meeting about 2/3 of domestic demand; imports are filling the gap and are about 450 thousand bpd.

Pertamina's refineries are located in Sumatra, Java, East Kalimantan and Irian Jaya. They produce a mix of finished petroleum products, and refinery feedstocks (such as naphtha) and non-fuels (such as asphalt and lubricants). Excluding the small Cepu refinery, their details are:

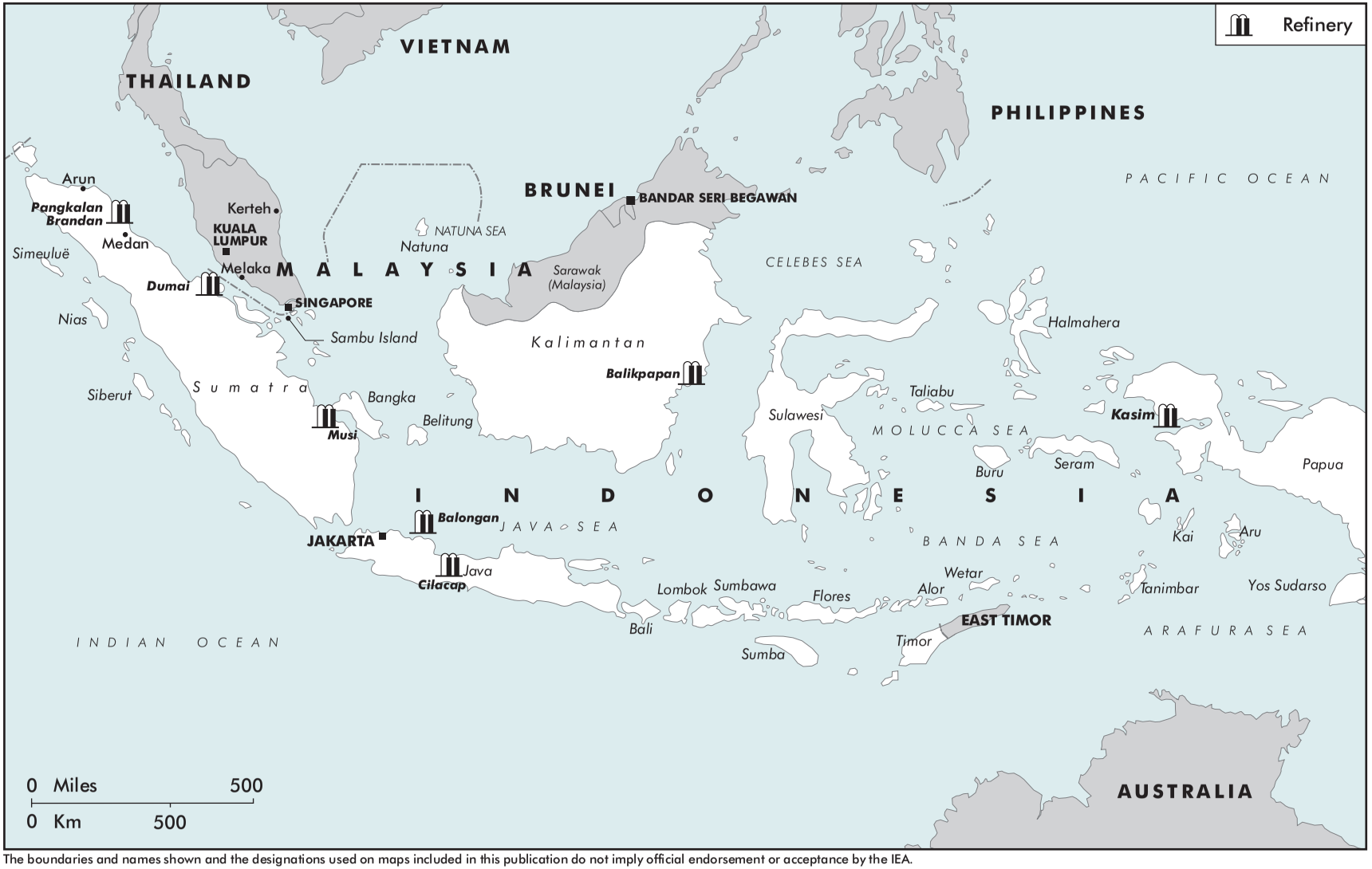
Table 8.4 ..... Oil refinery capacity (thousand barrels/day)

Refinery	Installed capacity
Pangkalan Brandan	5.0
Dumai	120.0
Sungai Pakning	50.0
Musi	135.2
Balongan	125.0
Cilacap	348.0
Balikpapan	260.0
Cepu	3.8
Kasim	10.0
Total	1 057.0

Source: Ministry of Energy and Mineral Resources.

- Pangkalan Brandan, North Sumatra: This small, aging refinery consists of a simple (primary) distillation unit, with no secondary processing unit. Its products are premium fuels, diesel, low sulphur wax residue (LSWR) and asphalt. Pangkalan has a processing capacity of 5 000 bpd. This facility was made idle in 2007 due to lack of feedstock.
- Dumai, Riau, Central Sumatra: The refinery has both a primary and a secondary processing unit (hydro cracker), which can produce up to LPG, naphtha, heavy vacuum gas oil (HVGO) and green coke. Its processing capacity is 120 000 bpd.
- Sungai Pakning, Central Sumatra: Built around 1957, the plant refines heavy paraffin crude oil to produce diesel and paraffin, with a capacity of 50 000 bpd.
- Kilang Plaju (Musi), South Sumatra: The aged refinery was built by Shell in 1930. It consists of both a primary unit and a secondary processing unit. The secondary unit (fuel catalytic cracker unit) can process up to 135 000 bpd and was designed to produce purified terephthalic acid (PTA) and Polytam for plastics. In August 2003, operating problems at Plaju closed the refinery for one month, delaying maintenance on the Balongan refinery. Pertamina has proposed converting the facility into a petrochemical plant by 2008.
- Cilacap, Central Java: Indonesia's largest refinery is located in Central Java and has a 348 000 bpd capacity. Its products are premium fuel, kerosene, diesel, fuel oil and naphtha. Its secondary processing units are similar to that of Kilang Plaju, which use Middle East crude residues (high vacuum unit) to produce lubricant base oil and a 'cocktail crude', *i.e.* a mix of Indonesia and imported crude (visbreaker unit) to produce cracked naphtha, diesel and fuel oil. The bulk of crude supplies (up to 75%) are imported from Asia and the Middle East. Pertamina has signed a long-term import contract with Saudi Aramco to supply the refinery's crude requirements.
- Balikpapan II, Kalimantan: It is more modern than Cilacap and Dumai, and consists of both a primary unit and a secondary processing (hydro cracker) unit. The plant has a refining capacity of 220 000 bpd and can produce refined products up to wax. Bechtel upgraded the refinery in 1983. Unfortunately, due to the facility design, the plant cannot process crude from co-located crude oil producers in Indonesia (Total, Unocal, Talisman, and VICO). The refinery only processes imported crude oil.
- Balongan, West Java: Indonesia's newest state-owned refinery at Balongan in West Java has the capacity to process 125 000 bpd of domestic crude. It has two production

Figure 8.3 ..... Petroleum refineries in Indonesia



The boundaries and names shown and the designations used on maps included in this publication do not imply official endorsement or acceptance by the IEA.

Source: Ministry of Energy and Mineral Resources.

units: the crude distillation unit (CDU) and the residue catalytic cracking unit (RCCU). The CDU processes crude oil into naphtha, kerosene, automotive diesel and residue; the RCCU turns the residue from CDU into LPG and Premium, Super TT, and Premix gasoline. The RCCU, one of the world's largest, has processing capacity of 83 000 bpd, but has experienced problems since its commissioning in 1994. The refinery was initially designed to supply export markets, which is why it is also called the Exor (export oriented) I refinery.

Balongan supplies about 70% of Jakarta's refined product demand. The plant processes Duri crude (70%), Minas crude (20%) and Jatibarang crude (10%). Balongan was upgraded in 2005 with additional capacity to produce 52 000 bpd high octane motor component (HOMC) and increase LPG production by 200 tons/day. The upgrade was also part of government effort to increase use of non-leaded fuel. Pertamina's new diesel fuel, Pertamina DEX, is produced at this refinery.

- Kasim, Irian Jaya: This is a small, mini-refinery located in Irian Jaya and has only a simple distillation (primary) unit. Its main products are premium fuel, diesel and kerosene.

Refinery crude oil requirements and product specification

As outlined above, Pertamina's refineries are designed to operate on a mix of locally produced and imported crude oil. Pertamina's past capital investment directed toward processing a mix of crude oils, including lower quality crude oils, will continue to assist Pertamina when the difference in price between high quality crudes and low quality crudes is large.

MEMR advised that refinery product specification is formulated by considering Pertamina's refineries' capability, engine technology development, consumers' purchasing power and environmental aspects. For gasoline, improvement focus is on limiting aromatic, benzene, and olefin content, decreasing sulphur content, usage of fuel additives which are safe for engine and environment, and providing gasoline in several grades to meet consumers' needs. For ADO, the focus is on limiting aromatic content, improving cetane number, decreasing sulphur content, use of fuel additives that are technically and environmentally safe, and providing ADO in several grades and quality to meet consumers' needs.

Indonesia has been working to phase out leaded gasoline since the late 1990s. Under Ministry of Energy and Mineral Resources Decree No. 1585/1999, Pertamina was to have nationally supplied unleaded gasoline by January 2003, but insufficient capacity and funding constraints limited Pertamina's ability to supply unleaded gasoline nationwide. However, in 2007, the last leaded gasoline was successfully phased out.

Relatively inexpensive investments by Pertamina may result in substantial increases in its refinery capacity and improved specification through investment in add-on capacity (*e.g.*, adding a catalytic cracking unit to an existing refinery) or through investment in debottlenecking. However, given the likely upgrading in international fuel quality standards, Pertamina may be better served through investment in the development and

construction of new refineries to replace its aging capacity. As is happening globally, Indonesia's petroleum demand is for lighter-end transport fuels, and new refinery capacity producing a larger yield of light products is likely to be more economic than aging capacity producing heavier products (*e.g.* residual fuel oil).

However, Pertamina has to buy its crude oil at world market prices and, while it sells petroleum products into a largely subsidised market, it confronts a cash-flow problem in meeting the needs for new investment. Fully corporatising Pertamina and selling shares to the public could raise cash for investment in current refinery enhancement or new refineries.

New refinery projects

The Oil and Gas Law No. 22/2001 permits new entrants to enter Indonesia's petroleum refinery sector in competition with Pertamina, and discussions with the MEMR indicate that a number of projects are in the economic and engineering study stage. However, several projects have been proposed in the past but have not proceeded.

Review discussions indicated that the biggest obstacle to new entry is securing a long-term supply of crude oil. Crude oil suppliers appear to be wary of signing contracts with potential refiners because the downstream market remains divided between subsidised and non-subsidised products and this division risks insufficient market demand at market-orientated prices to provide financial stability for new refiners.

Several crude oil suppliers also indicated that they are reluctant to provide long-term crude supplies without some form of active support of Pertamina in a project. While Pertamina no longer has monopoly control of the downstream distribution and retail market under the new Oil and Gas Law, it does retain a highly effective presence: it continues to control a large portion of the downstream market, it has excellent relations with local governments, and it understands how to do business locally.

PRICING AND SUBSIDIES

Indonesia has a subsidised and a non-subsidised petroleum products market. Over time, the GOI has been working to both increase the price of subsidised fuels and to reduce the number of consuming sectors legally able to purchase subsidised fuels.

The GOI recognises that its subsidised fuel prices distort the efficient allocation of products in the market and leads to over-consumption and the undermining of its National Energy Policy goals of reducing oil's share of the energy mix to 20% by 2025. Both poor and rich benefit from price subsidies, undermining the government's goal of providing energy assistance to the poor.

It also requires Pertamina to continue its Public Service Obligations and limits entry by independent companies into the downstream market, thereby continuing to undermine the basis for the new Oil and Gas Law No. 22/2001.

Subsidised fuels

By Presidential Decree No. 55/2005, subsidised fuels are 'Premium' gasoline (88 octane) and automotive diesel oil (ADO) used in transport (the largest subsidised market), and kerosene widely used for cooking and lighting by the poor and seen as a 'social fuel'. Between them, they account for about 2/3 of petroleum fuel sales.

Indonesia's subsidised fuel prices are amongst Asia's cheapest and are around 30% of the world price. Subsidised fuels can legally be used only for transport, households, certain types of fishing boats, and public service facilities. However, subsidised fuels are sold at retail outlets at the subsidised price and are equally accessible to both the wealthy and the poor. In this situation, subsidies are a poorly targeted instrument for assisting those most in need, and the wealthy understandably gain the greatest financial benefit from them.

Table 8.5 ..... Subsidised fuel price changes, 2004-2008

	2004		Mar. 2005		Oct. 2005		May 2008	
Fuel type	**Rp/litre**	***USD/litre**	**Rp/litre**	***USD/litre**	**Rp/litre**	***USD/litre**	**Rp/litre**	***USD/litre**
'Premium' Gasoline	1 810	0.20	2 400	0.26	4 500	0.50	6 000	0.65
ADO	1 650	0.18	2 100	0.23	4 300	0.47	5 500	0.60
Kerosene	700	0.08	700	0.08	2 000	0.22	2 500	0.27

*Assumed exchange rate of 9 100 Rp / USD 1.00.
Source: Ministry of Energy and Mineral Resources.

Their financial and political management is considerable. Due to the political sensitivity over these well-entrenched subsidies, Indonesia's previous administrations have taken few steps to remove them. Moves to reduce the subsidies contributed partly to the downfall of President Suharto in 1998. In 2003, street protests forced President Megawati's government to rescind a price rise amid fears for her presidency.

Under the Oil and Gas Law No. 22/2001, the elimination of the subsidies was originally intended for completion by November 2005. However, the strength of the community and administration resistance to a (successful) subsidised products price increase in October 2004 resulted in the Energy and Mineral Resources Minister Purnomo announcing in early 2005 that the government will gradually liberalise the domestic fuel market over the next five years, with the aim of completely eliminating fuel subsidies by 2010.

A substantial cross-border price differential is a recipe for smuggling, and Indonesia's subsidised fuel prices made smuggling petroleum out of Indonesia a lucrative business. The cost to the GOI of the smuggling is difficult to determine but, in 2005, it was conservatively estimated at USD 850 million. Additional smaller scale smuggling and fuel

adulteration also developed based on the growing price differential between the pump price paid by individual Indonesian's and the higher market price paid by Indonesia's non-subsidised industries. The GOI pursued smuggling syndicates that were working in collaboration with officials of Pertamina, the sole supplier of subsidised fuels.

The unexpected surge in international crude and petroleum product prices to USD 70/barrel in 2005 made Indonesia's domestic fuel subsidies a critical budgetary and political issue for the GOI: the government's expenditure in 2005 on the crippling subsidies was budgeted for Rupiah 89.2 trillion (USD 8.7 billion). On 1 October 2005, the government raised subsidised prices by an average of 125%. While there was an immediate and significant dampening of fuel demand, particularly in the household sector, it does not appear to have been long lasting.

Energy pricing is a Presidential decision, and, despite subsequent scheduling by MEMR and other agencies to gradually eliminate the 'Premium' gasoline and ADO subsidies by 2006 and the kerosene subsidy by 2007 and to free up the large budgetary impost for other social and economic programmes, all further price increases in the subsidised fuels were put on hold until after the Presidential election in 2009.

The international crude oil price increases of 2007-08 to USD 135/bbl (May 2008), however, made this price fix untenable. Indonesia's Finance Ministry estimated that the cost of the combined subsidies for fuel and electricity would be some USD 20.5 billion in 2008, about 20% of total GOI spending and outstripping the combined GOI spending on housing, law and order, health and education. In response, the GOI increased subsidised fuel prices on 24 May 2008 by an average 28.7%, sparking further protests. This brought the cost of subsidised gasoline and ADO to USD 0.65/litre and USD 0.60/litre respectively, still amongst the cheapest fuel in Asia. Further increases were not discounted. A monthly cash handout scheme, intended to pass on USD 1.5 billion of the savings on fuel subsidies to about 19 million poor families, was instituted to help offset the rise in fuel and food prices. Recent reports indicate that this translates into about Rp 100 000/month/family.

Non-subsidised fuels

In July 2005, the GOI phased out the subsidies for industrial consumers and for high-octane transport fuels for private consumers. Pertamina and new entrants to the retail market offer high-octane transport fuels for the new vehicle fleet and pricing for these fuels is adjusted according to market prices. The general reference price for these fuels is based on the Mid Oil Platt Singapore (MOPS) plus market adjustments plus value added tax (VAT).

Fuel subsidy reduction programmes

MEMR continue to pursue alternative means to reduce the subsidy impost, primarily by focusing on means of reducing the volumes of subsidised fuels sales and

encouraging the establishment of a competitive market and fuel price competition in the marketplace.

The GOI has instituted a programme to reduce the use of kerosene (subsidised) by replacing it with liquefied petroleum gas (LPG) (non-subsidised). The programme relied on the free distribution of LPG bottles and stoves (approx. 4.03 million stoves distributed free in 2007) as an incentive for households to switch from kerosene to LPG. The programme goal is to sell 12.5 million bottles of LPG in order to reduce kerosene demand by 30% by 2009 but this may be optimistic. Review discussions in 2007 and early 2008 indicated that there was some early success but the programme may fail due to the nature of Indonesia's kerosene market:

- The capital investment required to start an LPG sales agent (Rp 500 million) business is about double that of a kerosene sales agent;
- Poorer households usually can afford the lower cost of kerosene bottle refills (of the order of Rp 2 000/ litre, including VAT) while the higher cost of LPG refill (Rp 12 750, including VAT, for a 3 litre refill) is a greater burden and often beyond their capacity; and
- Pertamina controls over 90% of the LPG market and buys LPG on the open market at about USD 550/tonne. However, it sells into the Indonesia market with the price fixed by government at USD 470/tonne. It was unclear whether government is providing Pertamina with sufficient funds to close this gap.

Note that the prices above are pre-May 2008 after which the subsidised petroleum prices were increased by an average 28.7%.

Another sector that will erode the subsidised fuel commitment is that of Indonesia's small but growing new passenger vehicle fleet. Modern passenger vehicles run on a minimum 92-95 octane and are not recommended to run on Indonesia's subsidised "Premium" 88 octane gasoline. As the older low-octane vehicles age, so the demand for subsidised gasoline will decline. The annual growth in passenger car sales since 2002 has averaged 20-25%.

Policies to remove barriers to the use of vehicle fuel substitutes or extenders should be pursued to lessen the budgetary burden of Indonesia's subsidised fuels and to provide a diversity of cost-effective vehicle fuel options. The significant vehicle fuel alternatives are biodiesel (using crude palm oil) as an ADO extender, Gasohol (using ethanol from sugar cane, cassava, etc) as a gasoline extender, and compressed natural gas (CNG) and LPG as gasoline substitutes. However, each of these should be pursued as they become cost-effective and within the framework of continuing the establishment of Indonesia's competitive open market in the downstream sector.

Continuing impact of international oil price increases

If international crude oil and petroleum prices continue to escalate past their current USD 135/bbl (May 2008), and Indonesia retains its cap on subsidised fuel prices, the cost of Indonesia's fuel subsidies will once again continue to escalate. Review Team discussions with officials in 2007 indicated their concern then about the resumption

in the spiralling cost of petroleum subsidies after the October 2005 125% price increase. With international oil prices exceeding USD 100/barrel, the Energy and Minerals Minister warned in early 2008 of the unsustainable subsidies bill, culminating in the May 2008 30% price increase. While political realities prevent the immediate phasing out of the subsidies, the GOI should move quickly after the 2009 elections are settled. Reducing and eliminating domestic fuel subsidies will lead to best practices and enhance investment opportunities in the downstream sector.

DISTRIBUTION AND RETAIL MARKET

In July 2004, two companies, Shell and Petronas, were issued with licenses for petroleum products distribution and retailing in competition with Pertamina's well entrenched 'monopoly' position. Under its continuing Public Service Obligation responsibility, Pertamina remains the sole seller and distributor of subsidised fuel products throughout Indonesia, while Shell and Petronas sell only non-subsidised fuels where they determine that a sufficient market exists. Other companies have expressed an interest in entering marketing of non-subsidised fuels, such as BP and Total, and are likely to enter in the near future. In this segment of the downstream market, liberalisation is slowly working.

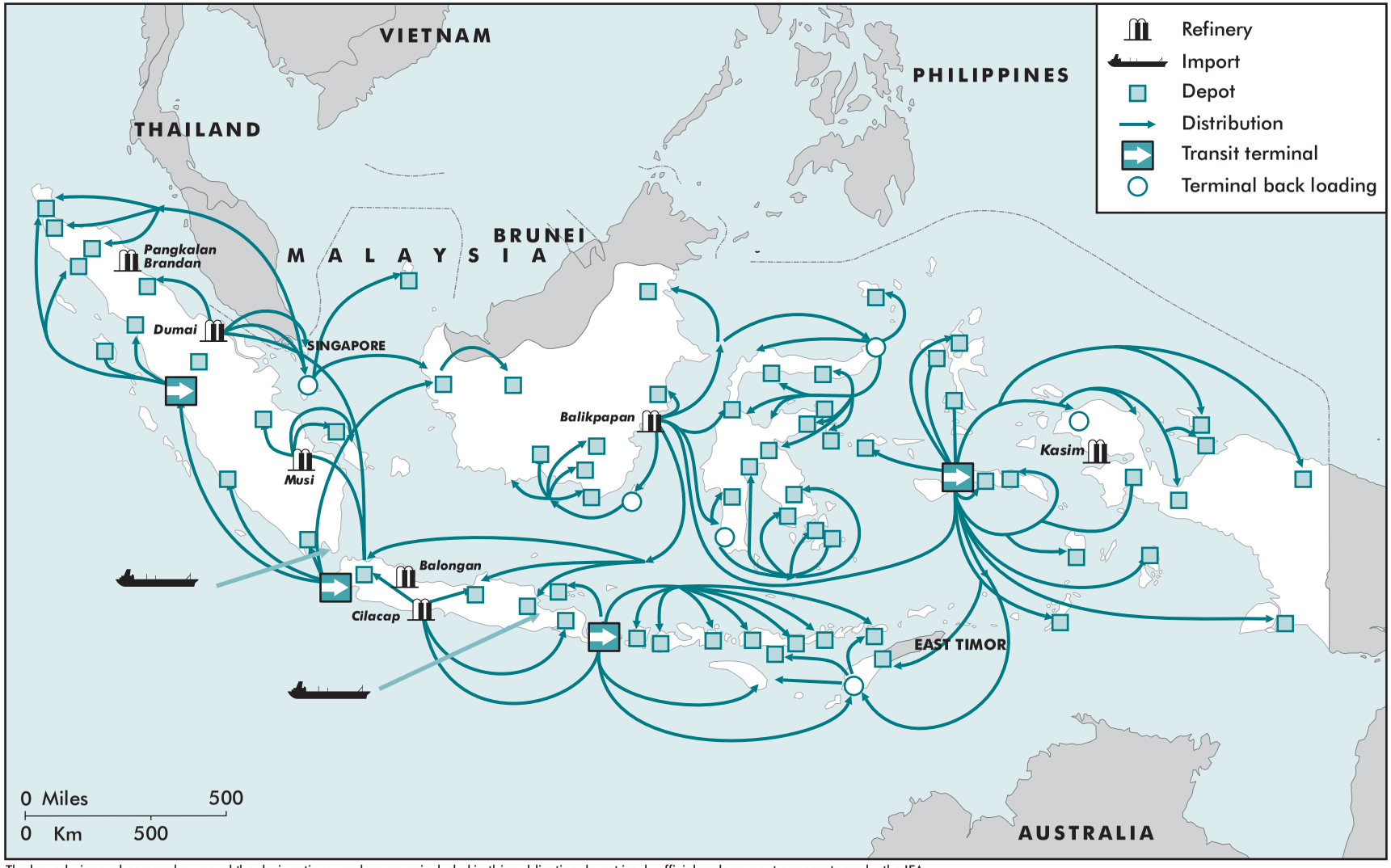
In downstream distribution and retailing, the challenge for the GOI is to remove the fuel subsidies and Pertamina's monopoly PSO while ensuring the security of the petroleum distribution and marketing network beyond the major cities and throughout the Indonesia archipelago. This is an important challenge for both the GOI and Pertamina in the establishment of the new Oil and Gas Law's open and competitive downstream market.

Pertamina and the changing market structure

In the downstream oil sector, Pertamina is responsible for the distribution of petroleum products to end-users from some 170 storage depots throughout the Indonesia archipelago. Products are transported via an elaborate pipeline network and by tank trucks, rail tank wagons, tank vessels and barges. Pertamina controls the sale of gasoline and ADO by direct ownership and franchise of close to 3 000 gasoline stations nationwide. Pertamina itself only owns 2% of the retail stations but has a close working relationship with Hiswana Migas, the National Association of downstream Oil and Gas Entrepreneurs.

A serious question is the future status of Pertamina. Review discussions indicated that an internal assessment is underway to determine how to re-structure Pertamina as it moves towards being a player in the open competitive upstream and downstream markets visualised under the new Oil and Gas Law. It remains a state-owned company and reports directly to the Ministry of State Owned Enterprises, but interacts extensively with MEMR, BP MIGAS and BPH MIGAS, and many other Ministries. Its state-owned status is both a benefit and a hindrance. It receives substantial non-cash

Figure 8.4 ..... Domestic fuel distribution



The boundaries and names shown and the designations used on maps included in this publication do not imply official endorsement or acceptance by the IEA.

Source: Ministry of Energy and Mineral Resources.

benefits due its status but at the same time it is taxed heavily (directly or indirectly), limiting its ability to invest in its ongoing operations. Serious consideration should be given to corporatising Pertamina so that it can use international credit markets to obtain cash for re-investment to modernise its operations.

EMERGENCY RESPONSE MEASURES

Under Article 8 of the Oil and Gas Law, the GOI is responsible for preparing strategic petroleum reserves and guaranteeing their availability to support petroleum supply throughout Indonesia. Indonesia's Regulatory Body for Oil and Gas Downstream, BPH MIGAS, has an obligation to regulate and determine petroleum fuel reserves and inventory levels. It also has the responsibility to develop a national emergency preparedness plan. During discussions with BPH MIGAS, such a plan was not made explicit.

The GOI continues to impose a stockholding obligation on Pertamina to maintain operational stocks equivalent to about 20 days of domestic demand. In August 2004, during heightened community concern over the upward oil price trend, Pertamina saw a need to reassure the Indonesian public, and advised that, in a supply disruption situation, the current stocks would last 23 days. In an archipelagic country with considerable political and community tensions, ensuring adequate petroleum supplies and community confidence in its many and often distant demand centres takes on a strategic importance, and Indonesian stocks of 23 days may not be seen as large enough for effective protection in times of crisis. Retaining this obligation on Pertamina also delays its transition to being one of many downstream sector players.

Implementing provisions of the new Energy Law

Under Article 6 'Energy Crisis and Emergency Situation' of the new Energy Law No. 30/2007, the GOI is obliged to take necessary action to overcome the condition of an energy crisis and emergency situation. The new National Energy Council has responsibility, amongst its many functions, to stipulate measures to overcome the condition of an energy crisis and emergency.

The National Energy Council will have decision-making authority: its Chairman and Vice Chairman will be the President and Vice President of Indonesia respectively. The Executive Chairman will be the Minister of Energy and Members of the Council will include the Minister and other high ranking officials that are directly responsible for supplying, transporting, distributing and utilising energy.

The National Energy Council is to be established within 6 months of the enforcement of the new Energy Law and its technical directives are to be stipulated within one year of the Law's enforcement. It is critical at this time to evaluate the risks of oil supply disruption to the domestic economy, and to establish a national oil emergency

preparedness plan to anticipate and manage oil supply disruptions. Many countries have established national oil emergency preparedness legislation procedures and measures, and information on such models is available from the International Energy Agency for consideration by the GOI.

Conclusions and recommendations

Further liberalisation of Indonesia's previously state-controlled downstream oil market is essential to attract the new entrants and investment that is required for Indonesia to meet its domestic needs in a competitive market. The timetable envisaged for this transition under the new Oil and Gas Law No. 22/2001 is past and this exemplifies the complexity of implementing this transition, particularly the removal of the entrenched domestic fuel subsidies and Pertamina's effective market monopoly outside the major cities while maintaining fuel supply throughout this fast developing economy.

The IEA Review Team recommends that the Government of Indonesia:

- Clearly demarcate the responsibilities and lines of authority of the independent downstream oil and gas regulator, BPH MIGAS, to avoid duplication and to ensure effective co-ordination with MEMR and other Ministries.
- Consider separation of Pertamina into upstream and downstream companies to enable its downstream companies to better focus on their core business and the increasing competition in the domestic sector:
  - corporatise Pertamina businesses by selling a minority stake of each to the public in order to raise capital for critical downstream investments as well as improve the companies' market responsiveness;
  - eliminate the Public Service Obligation imposed upon Pertamina and open all fuel markets to competition; and
  - vigorously pursue enhanced investment in the refinery sector, including through the optimisation and expansion of current capacity and the building of grassroots refineries. Avoid new subsidies to Pertamina, including any special prices for refinery feedstocks.
- Prepare and publish a timetable with fixed milestones to phase out subsidised petroleum fuel prices.
- Evaluate the risks of oil supply disruption to the domestic economy (including export contracts), and establish an emergency response plan to manage oil supply disruptions.

IX. GAS DOWNSTREAM

OVERVIEW

Despite the wealth of its natural gas resource, Indonesia's domestic natural gas market has remained underdeveloped. Since 2003, as its natural gas production declined, Indonesia has faced an increasing gas supply-demand mismatch that has forced the Government of Indonesia (GOI) and the state-owned oil and gas company, Pertamina, to juggle Indonesia's liquefied natural gas (LNG) contract allocations to meet its export commitments and its domestic gas needs. National policy is for gas to take a bigger share of the domestic energy mix and the uncertainty in the availability of gas for LNG contracts versus domestic use will be exacerbated as the domestic gas grid is further developed.

Indonesia's downstream gas market is dominated by the state-owned company, PT Perusahaan Gas Negara Persero (known as PGN) with its focus on transmission, distribution and retailing of gas. Pertamina also transmits and wholesales gas to some large-scale users.

Policy makers and PGN are being challenged to meet the national policy for gas penetration by Indonesia's subsidised domestic gas prices and the lack of a nation-wide gas infrastructure between the distant and scattered gas fields and the domestic markets. The downstream gas industry has suffered from a lack of investment, and the unrealised domestic demand for gas has compelled policy makers to review investment conditions.

Despite the difficulties that do persist, the downstream gas sector is set to experience sound growth in the years to come. A key to its sound growth will be the speed of domestic price increases to reach cost-reflective pricing and the securing of reliable gas supplies.

POLICY OBJECTIVES

The implementation of the new Oil and Gas Law No. 22/2001, followed by several Ministry of State Owned Enterprises regulations (particularly Governmental Regulation No. 36/2004 on Downstream Oil and Gas Business Activity) aimed at the promotion of the gas sector, has changed the downstream gas market. Under Article 8 of the Oil and Gas Law, the GOI gives priority to the utilisation of natural gas for domestic needs, as well as the introduction of competition with an open access regime to transmission and distribution pipelines.

The state-owned company, PT Perusahaan Gas Negara Persero (PGN) plays the dominant role in the transmission, distribution and retailing of natural gas in Indonesia, while it's much larger brother, Pertamina, also transmits and wholesales gas to some domestic power plants and large-scale industrial users.

PGN was listed as a public company in December 2003. 55% of shares are owned by the GOI (Ministry of State Owned Enterprises) and 45% by the public; 77% of the public shares are owned by foreign investors. Under recent regulation, PGN comes under the supervision of the Ministry of State Owned Enterprises (rather than MEMR, as was previously).

The new Oil and Gas Law brought about a fundamental restructuring of the oil and gas sectors; the new Law required that the upstream and downstream oil and gas activities be regulated by separate state regulatory agencies. Indonesia's Oil and Gas Downstream Regulatory Body (BPH MIGAS) was established in 2002 to regulate and supervise the downstream pipeline transmission and distribution of natural gas. It also regulates and promotes the adoption of open and fair competition, the tariff on gas transport through pipelines, and the price of natural gas for households and small scale costumers.

In an attempt to diversify Indonesia's domestic energy mix and reduce petroleum demand, the GOI, under its Blueprint for National Energy Management 2005-2025, set a national energy policy goal of increasing the share of gas in the primary energy mix to 30% in 2025 (from 27% in 2006). To enable this, the GOI established a master plan in December 2006 to construct a national gas transmission and distribution network connecting the producing regions of Sumatra and Kalimantan with the major consuming regions of Java. The development of this master plan is also enshrined in the new Oil and Gas Law (Article 27).

Domestic gas prices have been far below international prices, although they are increasing. This upward movement of gas prices is attributable to the high international oil prices putting pressure on the GOI to reduce Indonesia's domestic petroleum product subsidies, thus making gas a more attractive alternative for consumers. A stable higher gas price regime will induce more gas supply to the domestic market, encourage investment on downstream gas infrastructure, and promote more efficient allocation of gas resources. The GOI policy in gas pricing is to lift domestic prices to the international level, but in a steady manner.

DOMESTIC GAS SECTOR STRUCTURE

Transmission and distribution systems

The country's limited natural gas transmission and distribution networks have been an obstacle to developing the country's gas market, both for small consumers and for large industrial consumers and power stations.

The major gas consuming markets of Java and Bali are distant from the producing regions of Sumatra, Kalimantan, Sulawesi and Papua, and no transportation networks exist between them. Hence, a key factor in the development of the Indonesian gas market is the construction in a timely manner of the integrated gas transmission and distribution networks which have been planned by the GOI.

PGN is currently engaged in two core businesses: gas transmission/wholesaling and gas distribution/retailing. PGN purchases natural gas from upstream gas suppliers such as Pertamina, BP Indonesia, Lapindo, Brantas, Conoco-Phillips and Ellipse and, together with its subsidiary, PT Transgasindo (TGI), operates more than 5 000 kilometres of gas transmission and distribution pipelines.

PGN transmission business activity consists of natural gas transportation from gas fields through high-pressure transmission pipeline networks to buyer stations for which PGN receives a toll fee. The company directly and through TGI operate transmission pipelines aggregating over 1 000 kilometres. PGN is also constructing two new transmission and distribution pipelines with a combined length of 1 110 kilometres from South Sumatra to West Java. In 2006, PGN had 82% market share of Indonesia's transmission, with the remaining 18% held by Pertagas, a subsidiary of Pertamina. Pertagas supplies gas to power plants and large-scale industrial consumers through its transmission pipelines.

PGN currently has nine regional gas distribution networks, located in Jakarta, Surabaya, Bogor, Medan, Cirebon, Pekanbaru, Batam, Palembang and Baten/West Java (under construction), with over 3 000 kilometres of distribution pipelines serving some 80 000 households, 1 500 commercial customers and 770 industrial customers. It should be noted that 98% of sales by volume were industrial.

In 2006, PGN had 87% market share of gas retailing, with the remaining 13% shared by six private retailers (EHK, Manggala, Banten Inti Gasindo, Sadikun, Bayu Buana and Rabana) which supply gas to small-scale industrial consumers through their distribution pipelines.

The existing pipeline networks have limited interconnectivity and this has constrained growth of domestic natural gas demand. Consequently, liquefied petroleum gas (LPG) and kerosene are the common fuels used for cooking and lighting. It is believed that there is a potential market for pipeline gas of some 25 million households in Indonesia, principally in and around the larger cities on Java.

A further obstacle associated with the pipeline networks is that they are operated by various companies, although PGN is the dominant operator. Such dispersal in pipeline ownership and operatorship is likely to increase in the future: BPH MIGAS pipeline tenders during 2005-2006 were won by PT Bakrie and Brothers Tbk (East Kalimantan – Central Java), PT Pertamina (Persero) (East Java – Central Java), and PT Rekayasa Industri (West Java – Central Java).

Figure 9.1 ..... Master plan of Indonesia's natural gas pipeline network

The boundaries and names shown and the designations used on maps included in this publication do not imply official endorsement or acceptance by the IEA.

Source: Ministry of Energy and Mineral Resources.

Table 9.1 ..... Gas transmission pipeline ownership

Company	Pipeline section	Length (km)
PT Bakrie and Brothers Tbk	Bontang (E. Kalimantan) - Semarang (C. Java)	1 219
PT Pertamina (Persero)	Gresik (E. Java) - Semarang (C. Java)	250
PT Rekayasa Industri	Cirebon (W. Java) - Semarang (C. Java)	230
PGN	Pagar Dewa (S. Sumatra) - Cilegon (W. Java)	373
	Grissik (S. Sumatra) - Muara Bekasi (W. Java)	628
	Duri - Dumai - Medan/Belawan (Riau - N. Sumatra)	671
Total		3 371

Source: BPH MIGAS.

In addition to the gas transmission construction projects, the GOI is planning to tender for additional infrastructure for transmission and distribution systems during 2007-2008.

Table 9.2 ..... Investment plan for gas pipeline infrastructure

Pipeline section	Length (km)	Capacity (million cubic feet/day)	Investment (USD million)	Tender year	Financing
Transmission					
Muara Bekasi - Cirebon	220	500-700	269	2007	Private
Donggi - Pomala - Sengkang	580	200	460	2008	
Banjarmasin - Palangkaraya - Pontianak	755	300	620		
Distribution					
Surabaya - Gresik	120	15-30	20	2007	Private
Probolinggo - Pasuruan	100	10	8		
Sidoarjo - Mojokerto	60	20	6		
Batam	125	50-125	15		
Lampung	180	50	20	2008	
Jambi	35	50	5		

Source: BPH MIGAS.

Recent communication from PGN indicated that it is seeking to establish a greater presence in Indonesia's gas distribution market. It has begun establishing distribution unit/districts for each of the Surabaya-Gresik District, Probolinggo-Pasuruan District, and Sidoarjo-Mojokerto District based on communications with BPH MIGAS in late 2005. It is similarly establishing distribution unit/districts for each of the Batam District and Lampung District based on communications with BPH MIGAS and MEMR.

Sumatra is a key to the integration of Indonesia's gas transmission networks, both domestically and with neighbouring Singapore and Malaysia. Under its gas transmission master plan, known as the Integrated Gas Transportation System (IGTS), the GOI plans to build four additional domestic gas transmission pipelines to improve the

country's network connectivity. The IGTS is designed to eventually link the islands of Sumatra, Java, and Kalimantan via 4 200 kilometres of pipeline.

Thus far, the planned interconnection is partially complete only between Sumatra and Java. The IGTS is expected to be fully operational around 2010 with a capacity to transport 2 200 MMCF per day of natural gas. However, the controversial pipeline linking East Kalimantan to Java appears to have either collapsed or stalled due to questions over its economics and assured long-term gas supply from the maturing Kalimantan fields.

LNG receiving/regasification terminals

A means of leapfrogging the limited interconnectivity of Indonesia's gas transmission network and increasing the flexibility of Indonesia's domestic gas supply is the development of LNG receiving/regasification terminals close to Indonesia's demand centres. Two projects have been proposed for completion around 2013-14: one near Surabaya, east Java, of around 2-3 MTPA and the other near Cilegon, West Java, of around 4 MTPA. Such capacity is more common for LNG facilities servicing larger overseas markets, and this supports recent reports that PT PLN, Pertamina and PGN plan to jointly develop a single receiving/regasification terminal.

Demand

Indonesia's domestic gas demand is growing slowly, while gas production has been in decline since 2003. Since 2005, Indonesia's LNG export contracts into north Asia have borne the brunt of this growing supply-demand mismatch and will continue to do so. In 2006, domestic consumption including losses/flared reached 3 716 MMCF per day, accounting for 46% of total production of 8 093 MMCF per day. 54% of production was exported, 90% as LNG and 10% as piped gas to Singapore and Malaysia. This trend continued into 2007.

Table 9.3 ..... Domestic gas vs. gas export (million cubic feet/day)

	2001	2002	2003	2004	2005	2006	2007
Domestic gas	3 134	3 111	3 186	3 170	3 208	3 408	3 504
Export gas	4 193	4 769	5 049	4 762	4 615	4 377	4 182
Gas flare	491	440	407	350	355	308	268
Total	7 819	8 319	8 642	8 283	8 179	8 093	7 954

Source: Ministry of Energy and Mineral Resources.

The major consumers of domestic gas are the fertiliser industry and power stations, followed by the petrochemical industry. Recent increases in gas demand are attributed largely to replacement of high-priced oil products with gas, and natural gas is thought to have substituted some 1.9 billion barrels of oil usage in 2006.

Table 9.4 ..... Domestic gas demand vs. export gas demand, 2006

Domestic demand	Million cubic feet/day	% share
Fertilizer	520.0	6.4
Refinery	41.5	0.5
Petrochemical	150.2	1.9
Condensate	38.9	0.5
LPG	90.1	1.1
PGN	909.6	11.2
PT PLN	463.8	5.7
Other industry	309.7	3.8
Own use	884.0	10.9
Gas flare	308.3	3.8
Subtotal domestic (incl. flared)	3 716.2	45.9
LNG exports	3 934.5	48.6
Piped gas exports	442.6	5.5
Subtotal exports	4 377.2	54.1
Total demand (incl. flared)	8 093.4	100.0

Source: Ministry of Energy and Mineral Resources.

Compressed natural gas (CNG) has been consumed in CNG vehicles in Indonesia since 1987. The number of CNG vehicles increased rapidly due to a strong government programme, and reached 6 633 vehicles in 2000 with forty CNG filling stations in operation. However, it has since declined to 500 vehicles and, more surprisingly, only one out of the forty filling stations is barely maintaining the business in 2006. Review discussions pointed to the CNG vehicle promotion collapsing in the face of uncertainty of gas supply to the filling stations.

The increasing domestic gas demand is expected to continue in the coming decades. The downstream oil and gas regulator, BPH MIGAS, has projected domestic gas demand to more than double to over 8 000 MMCF/D by 2025, in which power generation will account for 60-65%. To satisfy this projected demand, domestic gas supply and market uptake will have to double within 10-15 years, and this will depend on both gas supply infrastructure investment and the degree of substitution from oil into gas and gas vs. coal for both current and planned projects. The overall effect is therefore very uncertain.

Pricing

Supply of gas to Indonesia's domestic market has become a higher political priority over the obligations of the contract LNG export market in the face of the developing gas supply-demand mismatch. The new Oil and Gas Law also requires producers to comply with a Domestic Market Obligation (DMO) of offering 25% of oil and gas production to the domestic market.

The new Oil and Gas Law stipulates that the price for petroleum products and natural gas shall be left to the mechanism of healthy and fair business competition (Article 28). However, it also stipulates that the Oil and Gas Downstream Regulatory Body, BPH MIGAS, shall regulate the tariff for natural gas transportation through the pipeline and the price of natural gas for households and small-scale customers (Article 46).

The economies of scale in supplying gas to large-scale industry and power plants means that these customers receive relatively low tariffs through negotiation and they provide the main revenue source to the gas retailers. Relatively higher tariffs are charged for smaller scale industrial and other smaller consumers. The very small and regulated consumers, *i.e.* residential and commercial consumers, account for only 1-2% of domestic gas demand and receive regulated prices determined by BPH MIGAS. Small industrial consumers also receive a regulated price.

PGN has expressed a desire to expand urban gas distribution networks but claims that it would only be able to achieve this if it is allowed to command higher retail prices. Domestic gas prices charged to industrial consumers on average are only one third to one fourth of the price of competition fuels LPG and diesel, whose prices currently are in the range of USD 14-17/MMBTU. Although domestic gas prices are far below international prices, they have been increasing since October 2005. After the Presidential election in 2009, it is likely that regulated gas prices will continue to increase.

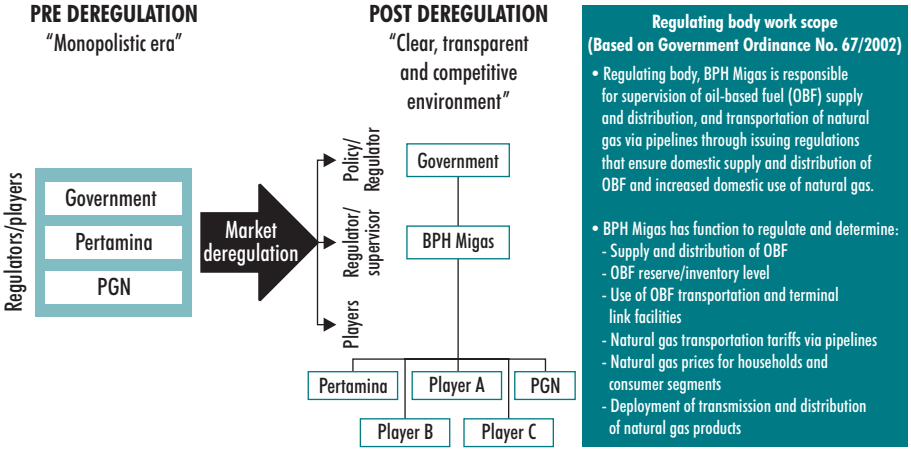
Removal of petroleum product subsidies and price caps and the application of cost-reflective pricing will not only induce investment from both domestic and foreign investors in the construction of downstream gas supply infrastructure, but will also ensure the best resource allocation. Critical to achieving these positive effects will be providing a clear and transparent schedule of domestic price increases for both subsidised petroleum products and regulated gas tariffs.

MARKET LIBERALISATION AND REGULATION

In recent years, the natural gas downstream sector has experienced many changes as a consequence of the impact of the new Oil and Gas Law No. 22/2001 on Pertamina's roles, the establishment of BPH MIGAS, the growing gas supply-demand mismatch, the cuts in petroleum product subsidies, and the adoption of a domestic gas utilisation policy.

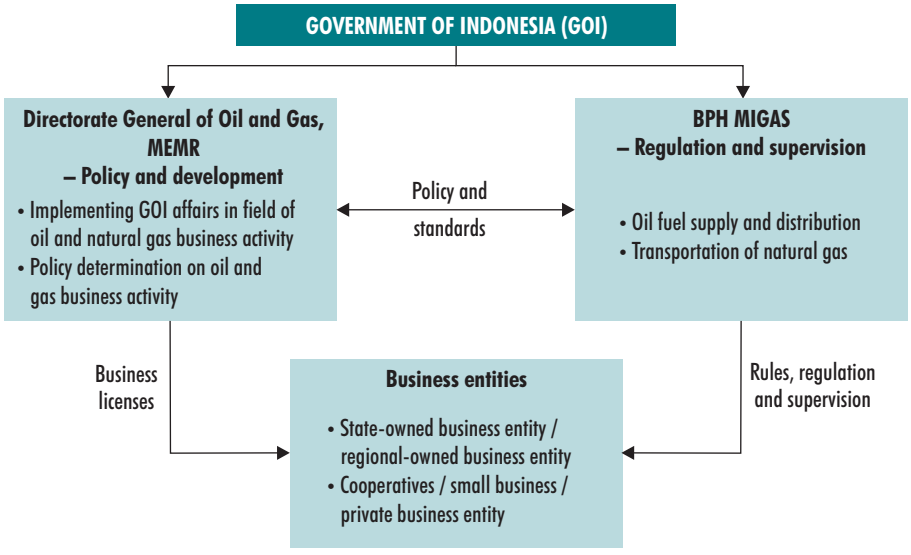
Indonesia's Regulatory Body for Oil and Gas Downstream, BPH MIGAS, was established in 2002 to regulate and supervise the downstream pipeline transmission and distribution and the sale of natural gas. It also regulates and promotes the adoption of open and fair competition, the tariff on gas transport through pipelines, and the price of natural gas for households and small scale costumers.

Figure 9.2 ..... Downstream oil and gas market structure



Source: BPH MIGAS.

Figure 9.3 ..... Downstream oil and gas market regulation and supervision



Source: BPH MIGAS.

The new Oil and Gas Law brought about a fundamental restructuring of the downstream gas sector. The Law stipulated that:

- government gives priority to the utilisation of natural gas for domestic needs (Article 8);
- gas transportation through pipelines that concern the public interest shall be regulated to the extent that it is open for all users (Article 8);
- separate business licenses be required for natural gas activities, including processing, transmission and distribution, storage, and trading (Article 23);

- government will develop a master plan for a national gas transmission and distribution network (Article 27);
- unbundling to prevent single-entity gas upstream and downstream activity (Article 10), prevention of pipeline monopoly control, and prevention of trading area monopoly (Article 27); and
- price for gas shall be left to the mechanism of healthy and fair business competition (Article 28), notwithstanding that BPH MIGAS will regulate the pipeline tariff for gas transportation and the price of gas for households and small-scale customers (Article 46).

NATIONAL GAS TRANSMISSION AND DISTRIBUTION NETWORK MASTER PLAN

Natural gas transmission and distribution by pipeline are natural monopolies, and require regulation and government oversight to ensure the interests of existing players, new business entrants and consumers are met. Under the Mineral Resources Decree No. 2950/2006, the GOI has issued a Master Plan for National Gas Transmission and Distribution as a reference to encourage private investment in the construction and ownership of an expanded transmission and distribution pipeline network.

The Master Plan will be updated annually and targets:

- accelerating the construction of gas infrastructures;
- accelerating the construction of small-scale LNG, hydrate gas and gas liquefaction refineries;
- developing CNG transportation facilities;
- developing LNG terminals and re-gasification facilities; and
- increasing consumption of domestic LPG, hydrate gas and liquefied gas products.

These goals can be further divided between use of natural gas in the transport sector and use by households:

- Transportation:
  - preparation for CNG in Jakarta and in Surabaya;
  - revitalisation of CNG Stations in Jakarta;
  - development of CNG station for Trans Batavia (bus way system);
  - standardisation and certification for CNG products and facilities;
  - converter kit supply;
  - personal education and training programme for CNG utilisation; and
  - National Integrated Gas Pipeline.
- Household use:
  - LPG utilisation to substitute kerosene for households;
  - setting up policy and regulation for LPG utilisation in household sector; and
  - providing raw material and infrastructures for LPG utilisation in household sector.

Review Team discussions noted that while the GOI is continuing the development of the Master Plan for National Gas Transmission and Distribution, there remains confusion and uncertainty surrounding the implementation of the GOI gas utilisation policy. Given the continuing gas supply-demand mismatch, a strong concern of private sector investors in downstream gas infrastructure and trading is the uncertainty around guarantees of availability of adequate gas supply. This was illustrated by the confusion over whether the Kalimantan-Java transmission pipeline would go ahead. There was also concern as to the issues of pipeline tariffs, gas pricing and the contentious Domestic Market Obligation for upstream gas projects.

COAL BED METHANE AS AN ALTERNATIVE GAS SOURCE

Coal bed methane (CBM) is gas which is trapped in coal seams that contains more than 97% of methane. CBM can thus be used as a source of natural gas to meet domestic gas requirements via pipeline networks. Exploitable CBM enhances the domestic security of gas supply and its utilisation reduces the GHG emissions impact of CBM leakage.

The Ministry of Energy and Mineral Resources has estimated Indonesia's CBM resource at 453 Tcf, of which at least 10% can be economically extracted. To date, there are no commercial CBM projects in operation due to a lack of interest by the coal companies in exploiting this important resource.

Under Indonesian law, CBM operations are treated as oil and gas operations, and CBM is under the jurisdiction of the MEMR Directorate General of Oil and Gas. A company intending to commercialise CBM reserves must enter into a CBM co-operation contract with the upstream oil and gas regulator, BP MIGAS, and this contract will share similarities with a production sharing contract (PSC).

Regulations on CBM include:

- Oil and Gas Law No. 22/2001.
- Governmental Regulation No. 36/2004 for Downstream Oil and Gas Business Activity.
- Ministry of Energy and Mineral Resources Regulation No. 33/2006 for CBM Business.
- Ministry of Energy and Mineral Resources Regulation No. 40/2006 for the Offering of Oil and Gas Operation Field.

MEMR Regulation No. 33/2006 aims at achieving a greater level of energy diversification and requires MEMR to establish policy for a CBM industry and to determine terms and conditions for CBM joint operation agreements and tender procedures for the working areas.

MEMR announced in 2007 that the GOI would offer CBM development projects to investors through tenders, and that first priority would be given to existing holders of coal rights and Contracts of Work or PSC holders over the concession area (as

per Ministerial Regulation No. 33/2006). In areas where there are no current coal concessions or PSC holders, the area will be open for tenders submitted along current PSC tender rules. A company intending to apply for a CBM development PSC must establish a separate company to undertake the CBM operations.

State-owned gas company, PGN, and state coal company, PT Tambang Batubara Bukit Asam (PTBA), signed a memorandum of understanding (MOU) in March 2007 to develop CBM at PTBA's mining concession in South Sumatra. The gas is intended for the PGN South Sumatra-West Java pipeline but it is unclear how much of that gas will be recoverable with current technology.

The GOI is investigating a pilot CBM project and providing funding for drilling five wells in South Sumatra sub-bituminous coal. The project will complete in 2008 with the proving up of the local gas resource. A national company, PT Medco, has been approved to undertake its commercialisation with a PSC split of 45% company and 55% government. The split for future CBM PSCs will be a function of perceived risk.

Conclusions and recommendations

Critical to encouraging investment from both domestic and foreign investors in the construction of Indonesia's domestic transmission and distribution pipeline and infrastructure will be providing a clear and transparent schedule of domestic price increases and the guarantee of gas supply. CBM also provides an opportunity to supplement current gas supply.

The introduction of competition through the application of an open access regime to transmission and distribution pipelines in the downstream gas market and expecting effective competition to take place may not be achievable at this early stage in the Indonesian domestic gas market. The lack of an integrated gas pipeline system, the ongoing low domestic gas prices, and the ownership by PGN of transmission and distribution pipelines as well as retail marketing hinders full opening of the downstream gas market in Indonesia. We urge the GOI to make this opening a long-term goal and implement the necessary changes that will allow it to meet this goal.

The IEA Review Team recommends that the Government of Indonesia:

- Facilitate the completion of the integrated gas transmission and distribution grids as planned by the GOI as it is essential for the development of the Indonesian domestic gas market.
- Improve the investment climate in the downstream gas sector by adopting good governance practices to enhance transparency and accountability of PT PGN. Specific measures should include:
  - the commercial ring-fencing, or accounting and legal separation, of PGN into two distinct business units, one in charge of operating supply facilities such as transmission and distribution pipelines and storage, the other one in charge of retail marketing, in order to enable fair and effective competition to take place in the downstream gas market;

- partial privatisation of each PGN business unit in order to raise capital for further investment; and
- as a precursor to partial privatisation, each PGN business unit should operate under a separate board and be required to prepare annual financial statements to international accounting standards and be subject to independent audit.

■ Establish and commit to a clear and transparent schedule of domestic price increases in the regulated gas tariffs to achieve market-orientated pricing.

■ Enhance the independence of the downstream gas regulator, BPH MIGAS, and give it the responsibility to:

- determine the network and retail charges to be levied by downstream gas retailers based on specific criteria which may include social and economic objectives; and
- establish fair and equitable rules for existing parties and new entrants by which third parties may gain access to the gas network.

■ Develop a policy framework and regulations for CBM tender procedures, and terms and conditions for CBM exploration and production that takes into account: the role of the coal company; the role of the local government as the permit issuer for coal mines; accounting guidelines to properly allocate costs to CBM and to coal production; and profit sharing between the operating company, the local authority, and the central government.

X. COAL

OVERVIEW

Indonesia is rich in coal resources, with 18.7 billion tonnes of coal identified as reserves and some 90 billion tonnes as potential resources. Today, Indonesia is one of the leading coal producing countries with production of 194 million tonnes in 2006 (preliminary data indicates production of 206 million tonnes in 2007), almost entirely from opencast mines. Of that, 48 million tonnes was consumed domestically, accounting for 17% of Indonesia's energy supply, and 144 million tonnes was exported (preliminary data indicates exports of around 157 million tonnes in 2007).

It should be noted that some anomalies and inconsistencies will be evident in the coal data, particularly for the preliminary 2007 data. As will be discussed later in the chapter, this is thought to stem from unreported or understated production and exports. MEMR and its Centre for Energy and Mineral Resources Data and Information (PUSDATIN) continues to work to resolve them.

Indonesia's coal industry showed impressive growth in the last ten years: production and exports increased, on average, 14 million tonnes and 11 million tonnes respectively per year. Indonesia is now the world's leading steam coal exporter with 148 million tonnes exported in 2006. The country removed the export tax in 2006 and Indonesia benefited from record high coal prices on global markets. Indonesia's new National Energy Policy aims to bring coal more strongly into the country's energy mix.

COAL POLICY AND ADMINISTRATION

The Government of Indonesia (GOI) National Coal Policy was established by MEMR in 2004 and has the following principal objectives:

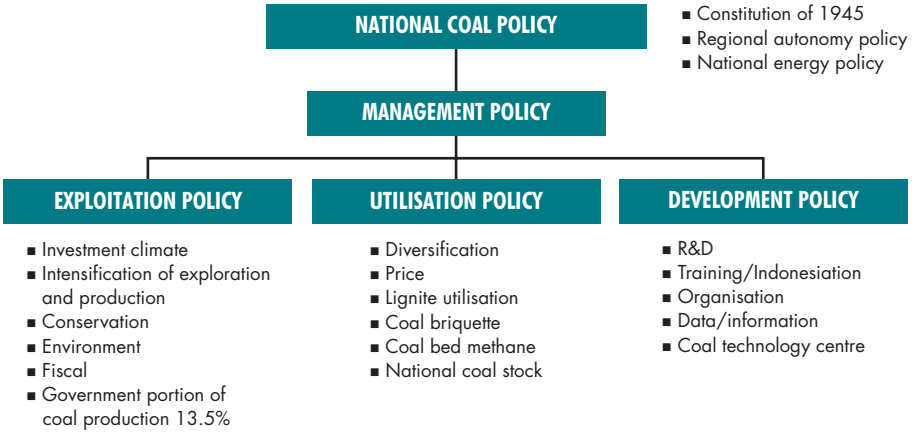
- Coal production is to be increased to meet rapidly growing domestic demand;
- Coal production is also to be increased to exploit export opportunities and generate a significant and reliable flow of foreign exchange;
- Coal industry should be able to compete globally and offer an internationally competitive investment framework;
- All qualities of coal reserves, including lower quality coals, are to be developed;
- Opportunities created by the development of the coal industry to provide economic and social development and to generate employment in more remote areas are to be pursued;
- An adequate supply of skilled manpower has to be ensured to staff the future expansion of the coal industry;

- The growth of the coal industry has to be consistent with the concept of sustainable development. The environment has to be protected as well as the safety and health of the industry labour force; and
- A role for small-scale mine operators in the industry is to be maintained. They have to be assisted to raise their mining, safety and environmental standards.

The National Coal Policy has been divided into four elements: management, exploitation, utilisation, and development policies:

- Management Policy: to reposition coal as a national source of energy, an export commodity, and a prime mover of economic, community and regional development;
- Exploitation Policy: to ensure the investment climate for coal mining is conducive and competitive, and to provide effective supervision in coal mining practices;
- Utilisation Policy: to increase the utilisation of coal and its role in fulfilling the national energy need; and
- Development Policy: to improve the development of coal as a domestic energy source and feedstock based on techno-economical and environmental aspects. Indonesiation (see Figure below) is a policy that aims to encourage and support a domestic coal sector.

Figure 10.1 ..... National Coal Policy



Source: Ministry of Energy and Mineral Resources.

While the policy and central administrative responsibilities of central government for coal matters lie with the Ministry of Energy and Mineral Resources and its Directorate General of Minerals, Coal and Geothermal (DGMC&G), the political decentralisation process of the 1990s has considerably impacted on central government and local governments management of current coal projects and investor interest for future coal developments.

The legal basis for mining operations in Indonesia is still the Law No. 11/1967 on the Basic Provisions on Mining (commonly known as the Mining Law) and Governmental Regulation No. 32/1969 regarding the implementation of the Mining Law, subsequently

amended by Government Regulations No. 79/1992 and No. 75/2001 on General Mining Activities. The Mining Law hasn't been updated since that time and it comes into conflict with provisions of the Law No. 22/1999 on Regional Governance and its partner Law No. 25/1999 on the Fiscal Balance between the Central Government and the Regions, and other laws and regulations. A new Mining Law is in preparation.

The split of responsibilities and tasks among the many government ministries and agencies has generally been specified in the Governmental Regulation No. 75/2001. This Regulation of year 2001 was intended to provide interim guidance until Government passed a new mining law to replace Mining Law No. 11/1967. It is hoped that the new Law on Mining of Minerals and Coal, long in preparation, will clarify these matters.

Ownership and management of coal developments

The existing Mining Law No. 11/1967 provides the legal framework for mining operations but some provisions are in conflict with Law No. 22/1999 on Regional Governance and Law No. 25/1999 on the Fiscal Balance between the Central Government and the Regions, which set out the framework for transferring responsibilities and human and financial resources from central government to the regions. The decentralisation to regional autonomy in 1999 transferred the power to issue mining permits and to oversee mining activities from MEMR to provincial and district governments. However, the power of issuance of land use permits still rests in central government, namely the Ministry of Forests.

The decentralisation to regional autonomy in 1999 retained the ownership of mineral rights in the state, and royalties from coal production are paid to the central government based on the Law No. 20/1997 on non-Tax State Revenue. Under the Autonomy Law No. 22/1999 and its later amendment, No. 32/2004, the royalties are then distributed 20% to the central government, 16% to the provincial government, 32% to the district government where the mine is located, and 32% to the other districts within the province where the mine is located. Additionally, the State Ministry of the Environment and the provincial and district governments each have mandates for environmental monitoring and management of mining. Residual responsibilities also remain with the MEMR.

A proposed new Mining Law is now in preparation and it is needed to clearly define the split of responsibilities among central government and the provincial and district governments for all matters. It is also needed to remove inconsistent and overlapping regulations issued by the central and local governments. Without the ability to clearly see the responsibilities, benefits and legal protection, large-scale potential investors will find it difficult to enter into mining projects. There is also a disconnection between the various central and local government authorities; for example, some mine operators failed to understand that a Ministry of Forests land permit was needed to conduct mining operations. A harmonized process – a one-stop shopping regime – is needed to reduce confusion on what is covered by a mine permit and a land permit.

Investment regulations and taxation

To maintain investment in exploration, new mines, and delivery infrastructure, the GOI must ensure that the legal framework for mining is clear, consistent and certain. A major issue for investment in coal mining is the conflict with forestry regulations. Under the Law No. 41/1999 on Forestry, mining cannot be allowed in higher quality "conservation forest" and this classification covers some 10% of Indonesian land. The Forestry Law also bans surface (opencast) mining from "protected forest" which covers some 17% of Indonesian land. This prevented coal mining in highly prospective areas. The GOI recently enacted Governmental Regulation No. 2/2008 on Non-Tax State Revenues originating from Utilisation of Forest Areas for development purposes other than Forestry Activities. This Regulation enables the issuing of mining licenses in production forests and protected forests for mining activities at the rental tariffs of Rp 1.8 million per hectare for production forests and Rp 3 million per hectare for protected forests per year. This Regulation is meeting some local community opposition.

Review Team discussions pointed to the need to create a legal framework for investments in coal mining that offered fair and internationally competitive conditions that are consistent across all investors. This would also address the uncertainties introduced in recent years in the field of taxation, such as the value added tax (VAT) "tax exempt" status of coal that means coal producers are unable to reclaim VAT paid on imported capital goods and services; the range of royalties, taxes, levies and fees; and the earlier export duty of 5% on coal exports to support coal utilisation in domestic power plants.

RESOURCES AND RESERVES

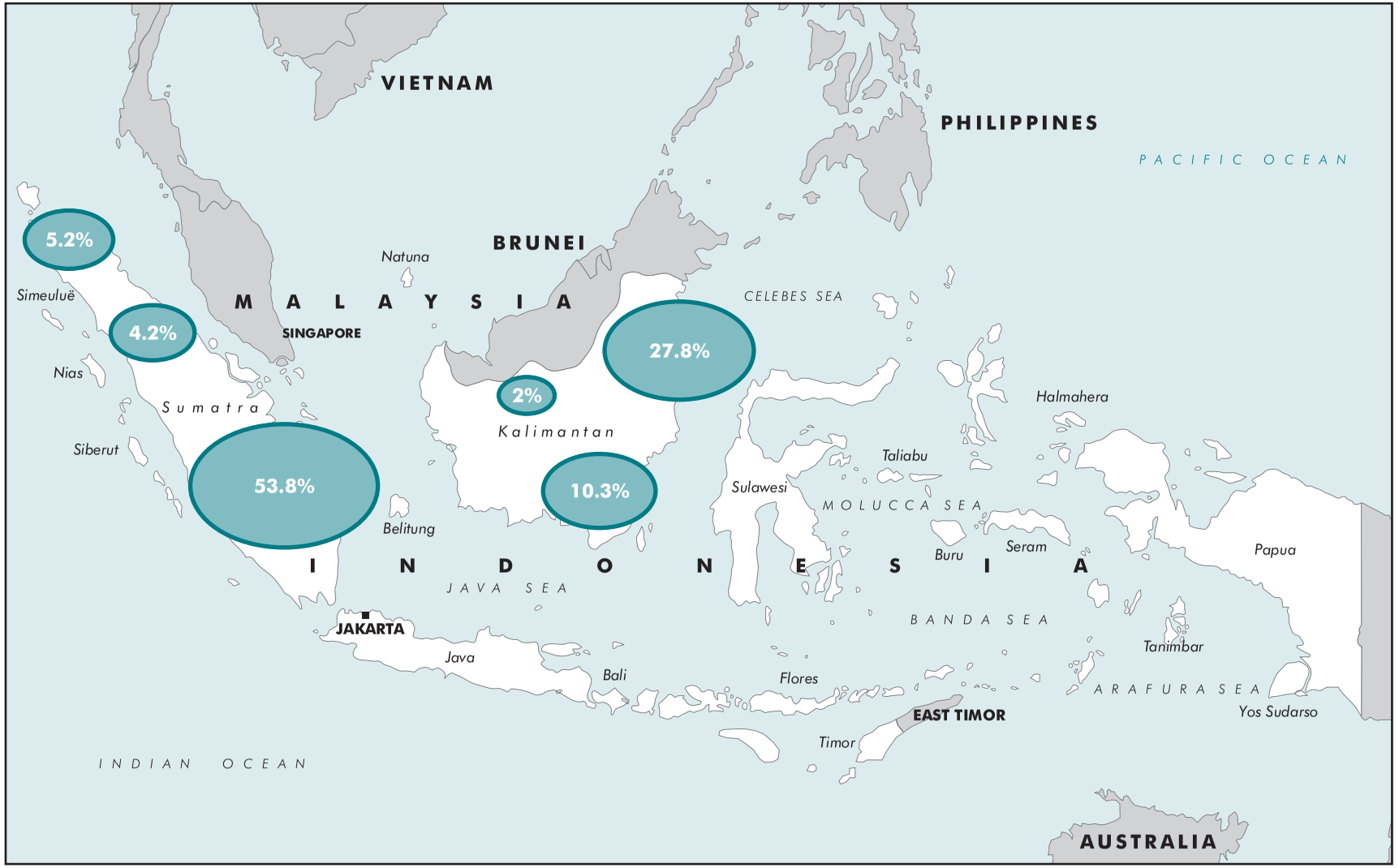
Indonesia has potential coal resources of around 90 billion tonnes with the biggest resources located in South Sumatra, East Kalimantan and South Kalimantan. The export quality coal (>CV 5 300 kcal/kg) is mainly found in East Kalimantan (about 60%), South Kalimantan (about 45%) and Central Kalimantan (about 75%).

Table 10.1 ..... Coal resources and reserves, 2007 (million tonnes)

Island	Resources					Reserves		
	Hypothetic	Inferred	Indicated	Measured	Total	Probable	Proven	Total
Java	5.47	6.65	0.00	2.09	14.21	0.00	0.00	0.00
Sumatra	20 148.47	13 949.29	10 734.37	7 699.18	52 531.31	12 997.82	904.80	13 902.62
Kalimantan	3 389.28	21 028.93	2 893.82	13 156.04	40 468.07	413.14	4 395.49	4 808.63
Sulawesi	0.00	146.91	33.09	53.10	233.10	n/a	n/a	n/a
Malaku	0.00	2.13	0.00	0.00	2.13	n/a	n/a	n/a
Papua	89.40	64.02	0.00	0.00	153.42	n/a	n/a	n/a
Total	23 632.62	35 197.93	13 661.29	20 910.41	93 402.24	13 410.96	5 300.29	18 711.25

Source: Ministry of Energy and Mineral Resources.

Figure 10.2..... Distribution of coal resource



The boundaries and names shown and the designations used on maps included in this publication do not imply official endorsement or acceptance by the IEA.

Note: Some disparity in totals may occur due to rounding.
Source: Ministry of Energy and Mineral Resources.

About 5.3 billion tonnes of Indonesia's coal resource are mineable proven coal reserves. An additional 13.4 billion tonnes is probable coal reserves. The biggest coal production is from East Kalimantan (about 55%) and South Kalimantan (40%), and, at current production levels, coal reserves are estimated to last some 90 years.

Indonesia's coal deposits are relatively young, reflected by the composition of the reserves, of which 60% is lignite (primarily South Sumatra), 26% sub-bituminous, 14% bituminous and less than 0.5% anthracite. Indonesian coals have a low content of ash and sulphur, making them some of the cleanest coals. But they have a high content of volatile components and moisture. Having nearly no coking properties, the coal can only be used as steam coal. Heat values of coal mined in Indonesia range between 5 000-7 000 kcal/kg. Because of its especially high moisture content and low heat value, Indonesia's lignite resource is mined in a very limited way.

INDUSTRY STRUCTURE

The Indonesian coal mining industry is comprised of 63 large domestic-owned private coal mining companies, 18 foreign-owned coal mining companies, one state-owned company, mining authorisation holders (MA) including co-operatives units, and illegal mining operators. The private and foreign-owned coal mining companies, and the state-owned company dominate production.

Coal Contract of Work

Coal mining is carried out under the two types of licenses, Coal Contract of Work (CCoW) and Mining Authorisation (MA). Currently, there are 80 companies entitled to CCoW and 36 of them are producing coal under their CCoWs. There are 442 companies holding Mining Authorisation, of which 169 are producing coal under their MAs.

The CCoW sets out the rights and obligations of the company in all phases of a mining operation, from exploration until mine closure. Any private company, domestic, foreign or joint venture, can conclude a CCoW with the GOI and, in general, a coal mining venture is based on a CCoW. Mining companies holding a CCOW are called 'contractors'.

There are three generations of coal mining companies entitled to CCoW. The first generation CCoWs were concluded in the 1980s, the second generation was concluded in 1994 and the third generation was granted between 1997 and 1999. Today, most of the coal mining companies are operated by the first generation contractors. The CCoWs contain equity divestment requirements for foreign investors: ten years after the start of production, 51% of a mining project has to be held by an Indonesian company. Consequently, many of the first generation contractors have reduced their equity in recent years. In 2001, for example, all shares in PT Kaltim Prima Coal (KPC),

jointly owned by Rio Tinto and BP Amoco, were sold to a holding company, PT Bumi Resources Tbk. PT Bumi Resources Tbk now owns not only KPC, Indonesia's second largest coal producer, but also 80% of PT Arutmin, the fourth largest producer. Bumi is currently Indonesia's largest coal producer (27% of national production in 2006).

Table 10.2..... Coal producing companies operating under CCoWs

No.	Company name	Gen.	Location
1	Adaro Indonesia	I	Paringin, Tabalong, Hulu Sungaiutara, South Kalimantan Province
2	Allied Indo Coal	I	Sawahlunto, West Sumatra Province
3	Arutmin Indonesia	I	Tanah Bumbu, Tanah Laut, South Kalimantan
4	Berau Coal	I	Berau, East Kalimantan Province
5	Indominco Mandiri	I	Kutai Kertanegara, East Kalimantan Province
6	Kaltim Prima Coal	I	Kutai Timur, East Kalimantan Province
7	Kendilo Coal Indonesia	I	Pasir, East Kalimantan Province
8	Kideco Jaya Agung	I	Pasir, East Kalimantan Province
9	Multi Harapan Hutama	I	Kutai Kertanegara, East Kalimantan Province
10	Tanito Harum	I	Kutai Kertanegara, East Kalimantan Province
11	Antang Gunung Meratus	II	Hulu Sungai Selatan Tengah, Banjar, Tapin, South Kalimantan
12	Bahari Cakrawala Sebuku	II	Kotabaru, South Kalimantan Province
13	Borneo Indobara	II	
14	Gunung Bayan pratama	II	Kutai Barat, East Kalimantan Province
15	Jorong Barutama Greston	II	Tanah Laut, South Kalimantan Province
16	Kartika Selabumi Mining	II	Kutai Kertanegara, East Kalimantan Province
17	Mandiri Intiperkasa	II	Nunukan, East Kalimantan Province
18	Marunda Graha Mineral	II	Murung Raya, Midlle Kalimantan
19	Riau bara Harum	II	Indragiri Hulu, Indragiri Hilir, Riau Province
20	Trubaindo Coal Mining	II	Kutai Barat, East Kalimantan Province
21	Bangun Banua Persada	III	Banjar, Tapin, South Kalimantan Province
22	Baramulti Sukses Sarana	III	Banjar Baru, Banjar, Tanah Laut, South Kalimantan Province
23	Dharma Puspita Mining	III	Kutai Kertanegara, East Kalimantan Province
24	Inti Tirta Prima Sakti	III	Sorolangun, Bangko, Batanghari, Musibanyuasin, Prov. Jambi and Prov. South Sumatera
25	Insani Bara Perkasa	III	Kutai Kertanegara, Kodya Samarinda, East Kalimantan Province
26	Interex Sacra Perkasa	III	Pasir, Tabalong, East Kalimantan Province
27	Kalimantan Energy Lestari	III	Kota Baru, South Kalimantan Province
28	Kadya Caraka Mulia	III	Banjar, South Kalimantan Province
29	Lanna Harita Indonesia	III	Kutai Kertanegara, Kodya Samarinda, East Kalimantan Province
30	Mahakam Sumberjaya	III	Kutai Kertanegara, Kodya Samarinda, East Kalimantan Province
31	Mantimin Coal Mining	III	Tabalong, Balangan, South Kalimantan Province
32	Nusantara Thermal Coal	III	Bungo Tebo, Province Jambi
33	PD Baramarta	III	Banjar, Tapin, South Kalimantan Province
34	Senamas Energindo Mulia	III	Kota Baru, South Kalimantan Province
35	Sumber Kurnia Buana	III	Tapin, Banjar, South Kalimantan Province
36	Tanjung Alam Jaya	III	Banjar, Tapin, South Kalimantan Province

Source: Ministry of Energy and Mineral Resources.

While some foreign investors, mainly from Australia, Japan, Korea and Thailand, are still engaged, national companies now hold the majority of most of Indonesia's big coal producers. Five large private mining companies, PT Bumi Resources, PT Adaro Indonesia, PT Kideco Jaya Agung, PT Berau Coal and PT Indominco Mandiri, produced more than 62% of Indonesia's coal production in 2006.

The state-owned coal producer, PT Bukit Asam (PTBA), was the partner for companies investing in coal mining for the first two generations of the CCoWs (1981-1991, 1994). This changed with the third generation CCoWs (1997-1999) when the GOI, represented by the Minister of Energy and Mineral Resources, became the partner for signing a CCoW.

Mining Authorisation

Besides the large contractor companies, there are many small firms and co-operatives operating under a Mining Authorisation (Kuasa Pertambangan or KP). A Mining Authorisation can be owned only by Indonesian nationals or companies and there are 442 companies holding Mining Authorisations, of which 169 are producing coal under their MA.

Small-scale mining and illegal mining

Small-scale mining done by local people, so-called "people's mining", is allowed by Article 11 of the 1967 Mining Law by the establishment of village unit co-operatives (locally known as Koperasi Unit Desa or KUDs). However, over recent years, illegal small-scale mining has dramatically increased and more than 90% of small-scale mining in Indonesia is regarded as illegal by the authorities and do not have permits (Pertambangan Tanpa Izin or PETI or mining without permits). Although it is difficult to pin down the exact number of illegal miners, some suggested that more than 20 000 are working in East Kalimantan alone.

Illegal mining is a problem for coal producers, potential investors, local communities, the local environment, and government revenues. A significant amount of coal is produced by illegal miners. Review Team discussions suggested that more than 5 million tonnes of coal is produced illegally each year, and a significant amount of the illegally mined coal goes to meet export market demand. Illegal coal mining is characterised by poor mining and environmental practices and little or no mine rehabilitation. They usually operate within the mineral area of legal companies and are also found in all three categories of forest land – conservation, protection, and production areas.

The GOI has recognised the situation and has introduced measures to crack down on illegal mining, including deploying police to track down illegal miners and arrest them. However, due to the scale of the illegal mining, local rural poverty and underemployment, and the significant number of people involved in the illegal

mining "coal chain", direct confrontation is unlikely to be sufficient to stop illegal mining.

An alternative to confrontation by the central government would be co-operation with all levels of governments, including village level authorities, to implement measures focussing on protection of the environment and communities in tandem with enforcing illegal miners' adoption of mining licensing and mining practices within a fixed transition period.

As elsewhere, Indonesian illegal mine operators generally lack knowledge and/or interest in responsible mining and mine rehabilitation practice. A key issue is working with local village-level authorities to track down illegal mine operators followed by a programme of education and enforcement of accepted practices within a fixed period. The central government may grant a grace period of between three and five years for this transition, with special measures including waver of royalties and taxes during the transition period and a phase-in tax regime after the transition period. This would be a one time only measure during the short-term transitional period.

Future industry structure

In recent years, Indonesia has lost some of its earlier appeal to foreign investors who have scaled back their activities in the coal sector, resulting in a decline in exploration. For as long as the 1967 Mining Law remains on the books to be updated, as announced by the GOI some years ago, there will remain uncertainty surrounding future regulations. Issues of lack of co-ordination between ministries, problems with regional autonomy, conflicts with forestry regulation, taxation problems and illegal mining add to foreign investor uncertainty.

PRODUCTION

Today, Indonesia is one of the leading coal producers. Indonesian coal mining began in the first half of the 1980s, when production amounted to less than 1 million tonnes. In 2006, Indonesia coal production reached 193.5 million tonnes, ranked seventh globally.

By province

In 2006, the black coal mines of the island of Kalimantan produced 93% of Indonesia's coal, about 182 million tonnes. The Province of East Kalimantan produced a recorded 116 million tonnes in 2006, accounting for 60% of production, while South Kalimantan produced a recorded 64 million tonnes, accounting for 33% of the country's production. Of the remainder, 5% of production came from the state-owned lignite mines of PTBA in South Sumatra.

Table 10.3..... Coal production by province, 2006 (million tonnes)

Province	CCoWs	MA	Total
East Kalimantan	102.4	13.9	116.3
South Kalimantan	57.7	6.8	64.5
Central Kalimantan	1.4		1.4
Riau	1.0	1.4	2.4
Bengkulu		0.5	0.5
South Sumatra (PTBA)		9.3	9.3
Total	162.4	31.8	193.5

Source: Ministry of Energy and Mineral Resources.

By contract type

By producing company, the CCoWs currently account for some 83% of Indonesia's total output, while the Mining Authorization holders and state-owned PTBA account for some 13% and 4% respectively of the country's coal production.

Table 10.4..... Coal production by contract type (million tonnes)

	2000	2002	2004	2005	2006	2007
PTBA	10.8	9.5	9.6	9.2	9.3	8.5
CCOW	60.1	86.3	113.2	133.9	162.4	171.5
MA	4.4	6.7	9.6	11.0	21.8	26.4
Total	75.6	102.5	132.4	154.1	193.5	206.4

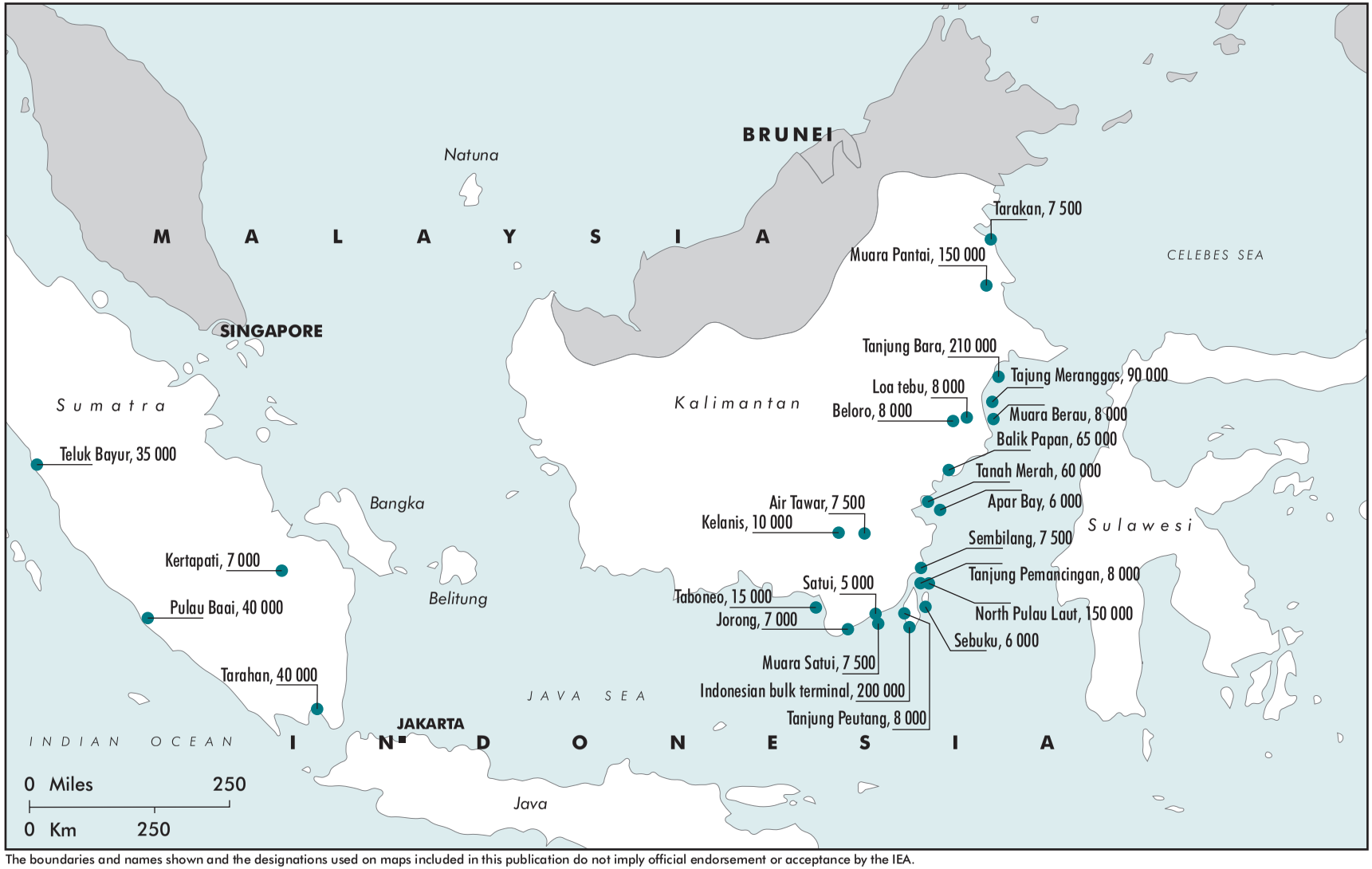
Source: Ministry of Energy and Mineral Resources.

By major producer

The major producers are located in either Kalimantan or South Sumatra (PTBA). The leading producers are Kaltim Prima Coal and Adaro Indonesia at close to 40 million tonnes each. Indominco Mandiri had the largest increase in production on a percentage basis from a little more than 7.5 million tonnes in 2005 to more than 11.5 million tonnes in 2007, an increase of 50%. Coal production from the state-owned PTBA remains stagnant due mostly to lack of investment and transportation difficulties.

In Indonesia, nearly all of the coal is extracted by opencast mining. Most mines use truck and shovel mining methods. Because of the consistent quality of Indonesian coal, the raw coal does not require special preparation. Crushing and screening are sufficient. Therefore, coal production costs are relatively low. PT Berau Coal, for example, reported production costs of USD 20 per tonne of coal for 2005.

Figure 10.3 ..... Coal terminals and capacity (maximum tonnes/day)



The boundaries and names shown and the designations used on maps included in this publication do not imply official endorsement or acceptance by the IEA.

Source: Ministry of Energy and Mineral Resources.

Table 10.5..... Coal production by major producers (million tonnes)

Company	Location	2004	2005	2006	2007
PT Kaltim Prima Coal	East Kalimantan	21.3	28.2	35.3	38.7
PT Adaro Indonesia	South Kalimantan	24.3	26.7	34.4	36.0
PT Kideco Jaya Agung	East Kalimantan	16.9	18.1	18.9	20.5
PT Arutmin Indonesia	West Sumatra	15.0	16.8	16.2	15.4
PT Berau Coal	East Kalimantan	9.1	9.2	10.5	11.8
PT Indominco Mandiri	East Kalimantan	7.1	7.5	10.3	11.5
PT Bukit Asam (state-owned)	South Sumatra	9.6	9.2	9.3	8.5
Other CCoWs		19.4	27.5	36.8	37.5
Local co operatives		9.6	11.0	21.8	26.4
Total		132.4	154.1	193.5	206.4

Source: Ministry of Energy and Mineral Resources.

Infrastructure and transportation

The ability of Indonesia's coal mining industry to meet demand depends on adequate infrastructure to move coal from mines to consumers. Most mines are close to tide water or river and coal is typically shipped by river barge, railways and trucks to sea port terminals or domestic consumers. Terminals may be sole company facilities or available to multiple producers. Export coal is mostly barged to sea port terminals and loaded on to the ships.

Most industry respondents consider that coal transportation infrastructure in Indonesia is adequate at present but see problems in the future. A study has been undertaken to assess a railway coal transport system and infrastructure links to coal deposits and terminals in northern East Kalimantan, Central Kalimantan and southern South Kalimantan.

There are plans to construct new railways to meet the transport requirements, including a new railway in Kalimantan to link 38 CCoW coal mines by 2020. In south Sumatra, an expansion of the railway system is also planned. Recent discussions with MEMR indicated that construction will begin in 2008 as a joint venture between PT Bukit Asam and China Railways Engineering. The capacity by 2011 will be of the order of 30 million tonnes per year from its current 10 million tonnes per year. The project is worth some USD 1.1 billion.

EXPORTS

Indonesia surpassed Australia in 2006 to become the world's largest steam coal exporter. Exports of 144 million tonnes accounted for 25% of world steam coal trade. In 2007, this increased to some 157 million tonnes. (It should be noted that Review Team discussions indicated that exports should be closer to 170 million tonnes, as

discussed below.) Indonesia produces and exports only a small amount of metallurgical (coking) coal, estimated at around 5 million tonnes.

On average, Indonesia has exported about three quarters of its coal production, and coal exports have grown rapidly over the last ten years, from 31 million tonnes in 1995 to 144 million tonnes in 2006 and 157 million tonnes in 2007, a fivefold increase. Indonesian coal exporters have benefited from high global prices, which were over USD 50 per tonne during much of the second half of 2006 but have since more than trebled. Coal was the second most valuable non-oil and gas export during the year. Important joint ventures and equity spin-offs are a feature of the industry.

By destination

Close to three quarters of Indonesian coal exports have traditionally gone to Asian customers, with Japan being the largest importer of around 20-25% of Indonesia's coal exports. According to Global Trade Atlas, Japan imported 25, 29 and 31 million tonnes of coal from Indonesia in 2004, 2005 and 2006 respectively. However, MEMR recently advised a lower volume of exports, which were 19, 24 and 23 million tonnes respectively. This likely indicates ongoing data reporting issues that are thought to be attributable to unreported mining and exports, and it is a focus for MEMR data programmes.

Table 10.6..... Major coal export destinations (thousand tonnes)

Country	2000	2001	2002	2003	2004	2005	2006	2007
Japan	13 177	15 216	16 530	17 992	19 013	24 237	23 128	24 409
Taiwan	13 520	11 507	13 100	14 144	16 678	14 524	17 070	17 909
South Korea	4 779	5 552	5 633	6 966	9 690	9 964	10 925	13 707
Hong Kong	2 914	4 662	5 564	9 178	8 230	8 970	9 373	10 811
India	3 151	3 130	4 586	6 700	5 465	8 740	10 846	13 927
Thailand	2 654	2 318	3 155	4 075	2 217	4 256	4 298	5 693
Malaysia	2 761	2 098	6 239	3 823	4 315	4 028	5 293	6 000
Other	15 504	20 798	18 729	22 802	28 151	36 071	62 700	64 352
Total	58 460	65 281	73 536	85 680	93 759	110 790	143 633	156 808

Source: Ministry of Energy and Mineral Resources.

Other major Asian coal export destinations are Taiwan, South Korea, Hong Kong, India, and more recently, China. Exports to these four destinations accounted for about 40% of Indonesia's total coal exports. Asian markets are crucial for Indonesia's coal exports.

Indonesia coal exports to European customers increased rapidly in the last four years from under 10 million tonnes in 2002 to 21 million tonnes in 2006. Most important non-Asian buyers of Indonesian coal are Italy, Spain, the Netherlands, the United States, and the United Kingdom. The U.S. bought about 2% of Indonesian coal exports.

Table 10.7..... Coal exports by markets (million tonnes)

Region	2000	2001	2002	2003	2004	2005	2006	2007
Asia	46.5	47.2	60.2	66.2	70.4	80.2	89.8	105.6
Europe	8.9	10.2	9.3	12.8	12.0	14.8	21.0	16.1
Others	3.1	7.9	4.0	6.7	11.4	15.8	32.8	35.1
Total	58.5	65.3	73.5	85.7	93.8	110.8	143.6	156.8

Source: Ministry of Energy and Mineral Resources.

By exporter

The leading coal exporters are Kaltim Prima Coal, Adaro, Arutmin, Kideco Jaya Agung and Indominco Mandiri. Kaltim Prima and Indominco Mandiri export nearly their entire production, and Kaltim Prima Coal's export increased 28.3% compared with 2005. The significant export volume increase was from PT Adaro Indonesia with 7.1 million tonnes of increase in 2006, a jump of 41.1% from 2005. Export volumes of the other companies are in the range of 63% to 74%. State owned PTBA exported 2.8 million tonnes in 2006, accounting for 30% of its production.

Table 10.8..... Coal exports by major exporters (thousand tonnes)

Company	2004	2005	2006	Change
Kaltim Prima Coal	22 404	26 622	34 153	28.3%
Adaro Indonesia	15 099	17 317	24 440	41.1%
Arutmin	13 796	12 517	13 277	6.1%
Kideco Jaya Agung	10 966	11 831	13 455	13.7%
Indominco Mandiri	6 584	8 902	10 260	15.3%
Berau Coal	6 160	5 763	6 758	17.3%
PTBA	2 713	2 492	2 848	14.3%
Other	16 037	25 346	38 442	51.7%
Total	93 759	110 790	143 633	29.6%

Source: Ministry of Energy and Mineral Resources.

Outlook

To date, Indonesia's export coal producers have extended their infrastructure to keep step with increased demand for export volumes. Most mines are located near the coast or rivers, and coal is trucked directly to deep-water ports or to rivers where barges transfer coal to seagoing vessels. Until now, the construction of railroads hasn't been necessary, but, in the future, port capacities and infrastructure will have to be expanded in line with demand.

Of greater importance for Indonesia's export outlook is GOI energy policy. Industry analysts forecast increasingly strong international demand for Indonesian coal exports, driven by sustained economic growth, particularly in China and India, and sustained high oil and natural gas prices. Indonesia's official forecasts of coal exports levelling off at 150 million tonnes per year have been exceeded. In anticipation of their domestic requirements, China and India are increasingly investing in Indonesia's coal mines, and, during the Review Team discussions, Indonesian officials and industry spoke of coal export levels for the next few years being of the order of 150-170 million tonnes per year.

Table 10.9..... Coal exports forecast, 2007-2025 (million tonnes)

	2005	2006	Forecast						
			2007	2008	2009	2010	2015	2020	2025
Production	154	194	205	217	229	240	280	320	370
Domestic	41	49	57	68	79	90	130	170	220
Export	111	144	148	149	150	150	150	150	150

Source: Ministry of Energy and Mineral Resources.

It is noted that there is some domestic concern for Indonesia's high export levels. As recently observed with Vietnam's and China's coal export policy, the GOI has raised a similar prospect that it may not provide the future export volumes demanded by international markets in the face of its growing domestic coal demand. Indonesia's energy policy recognises the need for coal to play a bigger share in its domestic fuel mix for coal-fired power generation and heavy industry, and officials have recently both talked up and talked down limits to future coal exports.

DOMESTIC COAL DEMAND

In recent years, coal has become increasinghy important in Indonesia's energy mix: consumption has increased from 9 million tonnes in 1995 to 49 million tonnes in 2006, a fivefold increase in the last ten years.

Table 10.10..... Domestic coal sales (million tonnes)

1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
9.2	11.0	13.5	14.5	20.0	22.3	27.4	29.3	30.7	36.1	41.4	49.0	*62.6

* Preliminary data.
Source: Ministry of Energy and Mineral Resources.

About 57% of coal was consumed for power generation and 43% by industry, mainly cement plants and pulp/paper mills.

Table 10.11..... Coal consumption by end-user industry (million tonnes)

Consumption	2000	2002	2004	2005	2006	2007
Power plant	13.7	20.0	22.9	25.7	27.8	*35.5
Cement industry	2.2	4.7	5.6	5.2	5.3	*6.8
Other industry	6.4	4.6	7.7	10.5	15.9	*20.3
Total	22.3	29.3	36.1	41.4	49.0	*62.6

* Preliminary data.
Source: Ministry of Energy and Mineral Resources.

In 2006, coal's share of electricity production was 40%, followed by oil 30%, gas 19%, hydro 6% and geothermal 5%. The GOI is ambitious to change the fuel sources mix by 2010 to coal's share being 62%, followed by gas 18%, hydro 8%, geothermal 7% and oil 5%.

Declining domestic oil and gas production is pushing Indonesia towards greater coal-fired power generation. Coal is also preferred due to its relatively low price compared with oil and natural gas. The GOI plans to significantly increase coal-fired power generation by 8800 MW by 2009 (although this is likely to be delayed to 2010), resulting in much stronger domestic coal demand.

The so-called 10 000 MW 'Crash' Programme is designed to expedite Indonesia's electricity production. Part of the programme is to use coal to replace 4 500 MW of oil-fired generation capacity. Of the total 10 000 MW, 80% constitutes large-scale steam generation plants with capacity of between 135 and 600 MW. It is planned that these are to be developed by foreign contractors and will be coal-fired. The capital to construct 8 000 MW of the electricity generation plants is planned through Chinese funding. The remaining 20% are small-scale plants with capacity between 6 and 135 MW.

In 2006, the state-owned electricity company, PT PLN, signed letters of intent with five consortia to supply coal to existing power plants and the proposed power projects scheduled to commence operation in 2009 and 2010. In 2007, a MEMR study voiced doubts about the capacity of some of the producers to supply the electricity fast-track programme. There appeared to be issues surrounding clarity on the amount of proven reserves, or reserves being located in protected forests or overlapping with mining areas of other companies.

Clean coal technologies

Indonesia ranked nineteenth among fossil-fuel greenhouse gas emissions (GHG) emitting countries in 2002, with about 24% of CO_2 attributable to coal burning. Under the 10 000 MW 'Crash' Programme and its rapid expansion of coal-fired electricity production, CO_2 emissions will substantially increase. This will be further boosted with the GOI National Coal Policy of developing all qualities of coal reserves, including

lower quality coals. Carbon dioxide emissions from lignite-fired power plants are generally much higher than for comparable hard coal plants.

Low-rank lignite coal is an affordable resource and represents nearly 60% of Indonesia's proven recoverable reserves. It cannot be excluded from use for power generation, and this emphasises the need to intensify the exploration for new coal reserves and to use lignite in the most energy efficient way in cleaner coal burning technologies.

Huge efforts have been made internationally on cleaner coal technologies R&D to reduce emissions. Given the 30-40 year lifespan of coal-fired power plant, it is critical that Indonesia adopt the best available cleaner coal technologies in building the new coal-fired power plants so as to minimise GHG emissions into the longer term. It is essential to set standards for approval and require all new proposals to meet the criteria. Increasing energy supply is very important but the GOI should not sacrifice environmental considerations for a quick supply fix.

COAL LIQUEFACTION AND COAL UPGRADING

Under Presidential Instruction No. 2/2006 concerning Supply and Utilisation of Liquefied Coal as Alternative Energy ("Instruction No. 2"), the Minister of Economic Affairs is required to take any and all necessary steps in connection with the supply and utilisation of liquefied coal. The Minister of Energy and Mineral Resources is required to:

- stipulate policies for the supply and utilisation of liquefied coal;
- provide incentives for the development of liquefied coal as alternative energy; and
- encourage companies engaging in coal mining activities to provide liquefied coal.

Coal to liquids (CTL) technology is a complex multi-billion USD long-term investment with considerable concern for its high GHG emissions. While CTL may be considered on energy security grounds, at this time a clear cost/benefit analysis compared with other traditional and alternative production options for liquid fuel supply should be considered.

Indonesia is testing technologies that would raise the calorific value of its coal. A 5 million tonne per year plant is planned, and, if quickly adopted, this technology would make Indonesian coal even more attractive on the international market and allow exploitation of poorer quality reserves.

Conclusions and recommendations

Indonesia's coal resource offers an essential option for diversification of the domestic fuel mix, both now and longer term. The need for the dispersal of responsibilities and benefits for Indonesia's coal mining sector across central and local governments and communities is recognised. However, a consistent message that echoed through the Review Team discussions was the need for a commensurate consistency, long-term

certainty, and clarity in the legal framework for coal mining developments and in government administration.

The IEA Review Team recommends that the Government of Indonesia:

- Clarify the rights and responsibilities of central, provincial, and district governments for mining regulation, taxation, and licensing in the proposed new mining law.
- Create a consistent legal framework for investments in coal mining and related infrastructure that offers fair and internationally competitive conditions that is consistent across all investors.
- Pass the proposed new mining law and its implementing regulations as soon as possible.
- Streamline the current practice of issuing mining licenses and land use permits by creating a single, integrated and centralised agency. The agency shall be responsible to the Ministry of Energy and Mineral Resources, Ministry of Forests and Ministry of the Environment, regional and provincial authorities who are currently processing issuance of mining licenses. The agency will assess applications and issue both mining license and land permit at the same time if the requirements of laws and regulations on mining and land use are met. Once the agency is operating, other authorities should cease issuing licenses and permits.
- Develop and implement measures to bring illegal mining activities within the legitimate mining sector during a one-off fixed transition period, including:
  - in association with local authorities, develop and implement educational programmes for illegal mine operators to raise awareness of impacts of irresponsible mining practices;
  - assist illegal mine operators to develop appropriate mining and mine rehabilitation plans;
  - enforce mine licensing, the implementation of an approved mining and mine rehabilitation plan, and a reserve fund for mine reclamation and rehabilitation; and
  - provide transition period fiscal incentives, such as waver of royalties and taxes, to encourage illegal mining towards the regulated mining sector.
- Encourage the market adoption of efficient clean coal technologies, and ensure existing and future coal-fired power plants are operated more efficiently. In the short term, high coal prices will help ensure this, providing the GOI does not interfere in the price of coal for domestic power generation or impose coal export restrictions. In the longer term, the GOI will need to consider how the cost of carbon emissions are incorporated into the cost of power generation.

XI. ELECTRICITY

OVERVIEW

Indonesia is endowed with world class coal, gas, oil, geothermal and hydro-electric resources. In spite of its resource wealth, the Indonesian electricity sector faces significant challenges. In part, that challenge is geographical. The dispersed, mountainous and seismically active geography of the Indonesian archipelago is an impediment to the development of cost effective grid-connected electricity systems.

Of much greater significance has been the limited capacity of the Government of Indonesia (GOI) to mobilise the investment required to finance the required expansion of its power infrastructure. This is reflected in Indonesia having one of the lowest rates of electrification for comparable economies. In 2005, the electrification ratio was around 54%. The World Bank and others have estimated that this represents in the vicinity of 90 million potential customers without access to electricity.

The lack of investment in electricity generation capacity and supporting infrastructure is increasingly being felt through power restrictions, blackouts, and power quality issues such as voltage variance and frequency fluctuations. This is having a serious impact on the Indonesian economy, investment and society in general. A key disincentive to investment in the power sector is the subsidised price of electricity to consumers: the price that the state-owned electricity company, PT PLN, is permitted to charge only partially reflects its cost base.

The problems can be overcome if there is a preparedness to adjust current policy settings. The benefits of making the adjustments outlined will be seen through greater business investment, economic growth and wealth creation from which all Indonesians will benefit.

INDUSTRY STRUCTURE

The sector is dominated by the electric utility PT Perusahaan Listrik Negara (PT PLN), which is 100% owned by the Ministry of State Owned Enterprises. PT PLN had a total generation capacity in 2006 of 24 887 MW or roughly 86% of the country's generating capacity. Independent power producers (IPPs) provide another 3 450 MW and private power utilities (PPU) 746 MW.

PT PLN is divided into a number of subsidiary companies. This includes two electricity generation companies: PT Indonesia Power with generating capacity of 8 992 MW and PT Pembangkitan Jawa Bali, known as PT PJB, which has capacity totalling 6 476 MW.

Roughly two-thirds of installed generation capacity serves the main Java-Madura-Bali system where the majority of the population and industry are located. This system has the only inter-island interconnection. The balance of power generation can be found on smaller grid-connected systems located on Sumatra, Sulawesi and Kalimantan, which supply relatively small areas of those islands.

Installed capacity

Indonesia's power generation sector has a total installed capacity of around 29 500 MW (2007) serving around 32 million customers. Over 60% of Indonesia's installed capacity is oil-fired. Coal-fired capacity is almost 14% of total capacity and natural gas almost 5%. While a large share, almost 20%, of generation is obtained from renewable sources, there remains a heavy reliance on fossil fuels and particularly oil-fired generation.

Table 11.1 ..... Electricity capacity by fuel, 2007

	Total (MW)	Share
Oil	18 183	61.7%
Coal	4 095	13.9%
Natural gas	1 353	4.6%
Renewables	5 834	19.8%
Hydro	4 200	14.3%
Geothermal	1 090	3.7%
Biomass	445	1.5%
Mini-micro hydro	86	0.3%
Solar cell	12	-
Wind power	1	-
Total	29 465	

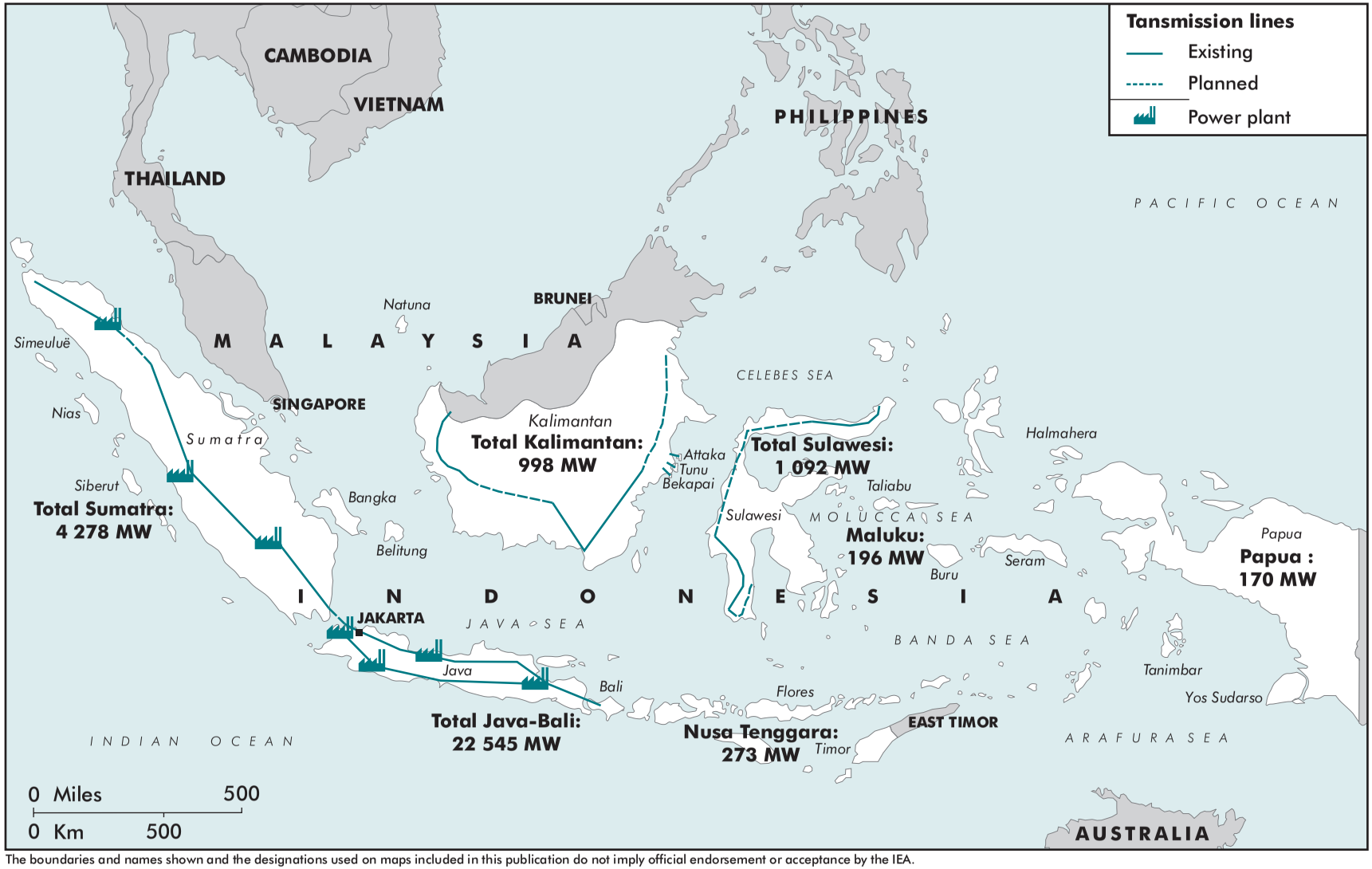
Note: Due to range of data sources, data is approximate.
Source: Ministry of Energy and Mineral Resources.

Generation

Electricity consumption in Indonesia grew at an average annual rate of 13% between 1990 and 1997, albeit from a moderate base. The high rate of growth in demand was driven by rapid economic expansion and extensions to the grid, with many new customers receiving electricity for the first time.

Up to 1997, investment in new generation capacity kept pace with the growth in demand. The situation changed markedly after the Asian financial crisis of 1997-98, which had a profound impact on the Indonesian economy. In the aftermath, economic activity declined sharply. While growth in electricity demand slowed briefly, it recovered quickly, reflecting strong underlying demand. Between 1997 and 2005, the growth rate of electricity consumption averaged 7% annually, and, in 2006, reportedly grew by 9%.

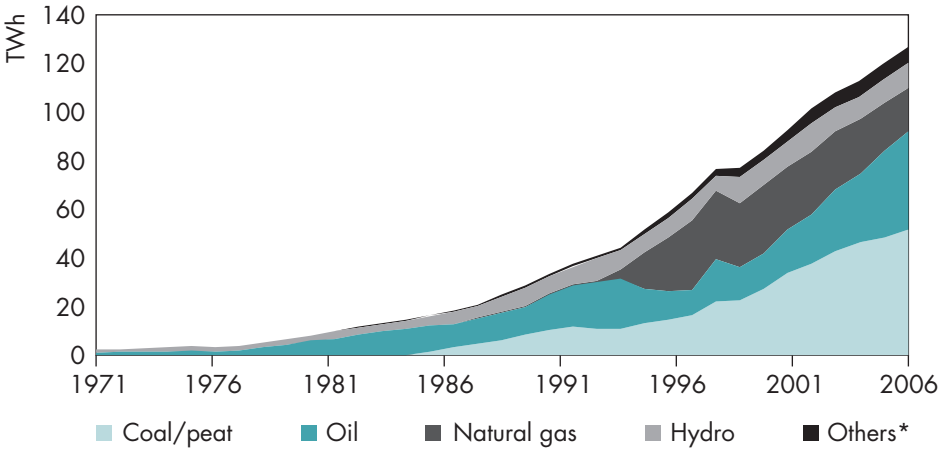
Figure 11.1 ..... Main power plants and domestic transmission lines, 2007



The boundaries and names shown and the designations used on maps included in this publication do not imply official endorsement or acceptance by the IEA.

Source: Ministry of Energy and Mineral Resources.

Figure 11.2 ..... Electricity generation by source



* Includes geothermal, solar, wind, combustible renewables and waste, etc.

Source: Energy Balances of Non-OECD Countries, IEA/OECD, Paris, 2008.

Table 11.2 ..... Power plant operating performance

	Average thermal efficiency	Capacity factor	Load factor	Peak load (MW)	Transmission and distribution losses
1990	32%	42%	67%	5 898	16%
1991	32%	42%	72%	6 130	14%
1992	30%	43%	73%	6 639	13%
1993	34%	38%	75%	7 409	12%
1994	29%	40%	68%	8 659	12%
1995	32%	44%	67%	9 896	12%
1996	29%	48%	69%	11 327	12%
1997	34%	46%	70%	12 818	12%
1998	35%	43%	69%	12 907	12%
1999	35%	45%	68%	14 316	12%
2000	34%	46%	70%	15 320	12%
2001	34%	48%	71%	16 314	14%
2002	35%	48%	72%	17 160	16%
2003	34%	50%	72%	17 949	17%
2004	34%	51%	73%	18 896	13%
2005	35%	52%	76%	19 263	12%
2006	34%	48%	64%	20.354	12%
2007	na	na	na	na	11%

Source: Ministry of Energy and Mineral Resources.

In terms of performance, Indonesia's power sector has shown measured progress in recent years. Average thermal efficiency and load factors have improved since 1990, and transmission and distribution losses have decreased over the same period. However, Review Team discussions indicated that this was not necessarily the case for reliability, power quality, and repair and maintenance.

Forecast demand

Based on the MEMR 'National Electricity General Plan' (RUKN) 2006-2026, Indonesia's electricity demand is forecast to triple over the next two decades, equivalent to an average annual increase of 7%. Peak load is forecast to rise by the same amount. A slightly higher share of the increases is forecast for outside Java-Madura-Bali.

Table 11.3..... National Electricity General Plan, 2006-2026

Area	Description	Unit	2006	2011	2016	2021	2026	Average annual change (2006-2026)
Java-Madura-Bali	Demand	TWh	92	129	178	242	327	6.5%
	Peak load	GW	15	21	29	40	59	7.1%
	Additional power plants	GW	-0.4	10	27	42	53	
Outside Java-Madura-Bali	Demand	TWh	23	33	50	77	123	8.7%
	Peak load	GW	5	7	10	14	17	6.3%
	Additional power plants	GW	0.9	5	9	16	37	
Total Indonesia	Demand	TWh	115	162	228	319	450	7.1%
	Peak load	GW	20	28	39	54	76	6.9%
	Additional power plants	GW	0.5	15	36	58	90	

Source: Ministry of Energy and Mineral Resources.

ELECTRICITY TARIFF SHORTFALL

Asian financial crisis and its aftermath

The root of many of the problems currently faced by the power sector in Indonesia can be traced back to the 1997-1998 Asian financial crisis. As discussed more fully in the next section on infrastructure investment, prior to the Asian financial crisis, investment in the power sector kept pace with the growth in demand. This included an increasing proportion of investment by foreign investors who had demonstrated increasing confidence in the direction and growth of the economy.

The recession triggered by the Asian financial crisis caused a dramatic four-fold depreciation of the Indonesian Rupiah against the US dollar, from less than 2 400

in 1996 to more than 10 000 after the recession. It remains at over 9 000 currently. Following the Rupiah currency collapse, average costs for PT PLN escalated dramatically due to rising fuel costs and rising contract costs with independent power producers (IPPs), each of which were denominated in US dollars.

Faced with this huge rise in costs in the period immediately after the Crisis, PT PLN found itself unable to meet its payments to IPPs. The relationship between the parties broke down, with most investors seeking recourse through arbitration or the courts in an attempt to enforce the terms of their contracts with PT PLN. These processes have invariably been described as both lengthy and acrimonious. All but one of the affected parties has since reached a settlement with PT PLN, for the most part on terms substantially below those contained in the original contract.

Since that time, the situation appears to have deteriorated even further for PT PLN. In particular, it has been forced to depend increasingly on its oil-fired generation capacity to meet the large growth in electricity demand. The dramatic rise in the international price of crude oil to beyond USD 100+ per barrel has greatly increased PT PLN costs in recent years. The fuel price situation has been compounded by PT PLN's limited ability to obtain gas to fuel its gas-fired generation plant, due to Indonesia's declining gas production and its growing supply-demand mismatch.

Political limits to addressing the revenue shortfall

On the revenue side, Indonesia has a complex electricity tariff structure divided into many customer classes. Tariffs apply within customer classes regardless of the financial circumstances of the customer. However, the tariffs are set by the GOI, and the power prices that PT PLN is permitted to charge have only partially been adjusted to reflect the change in its cost base.

The limited extent of tariff adjustment to date has meant that the price of power in real terms has fallen while input costs have continued to rise dramatically. It is understood that the average revenue received by PT PLN currently is equivalent to USD 6 cents per kilowatt hour, while costs on average are about USD 12 cents per kilowatt hour. Though PT PLN has called on the GOI to raise the tariff base, political will has prevented any action from being undertaken.

The GOI understands the pressing need to make adjustments to the electricity tariff. Some large one-off adjustments have been made in the past that were strongly opposed at the community level and triggered violent public demonstrations. Major power price adjustments are not politically acceptable and the GOI has stated that it will not increase electricity prices before the Presidential election in 2009.

Government subsidies to cover revenue shortfall

The difference between PT PLN costs and revenue is made up by the GOI. The size of the subsidy met by the GOI in 2005 was Rp 10-15 trillion (USD 1.6 billion). As

a result of the spiralling global oil price, the 2008 National Budget estimate was for an electricity subsidy of Rp 29.8 trillion (USD 3.2 billion). However, this was revised upwards to Rp 60.3 trillion (USD 6.4 billion) in early 2008 as petroleum product prices continued to spiral. Indonesia's Finance Ministry estimated in May 2008 that the combined subsidies for fuel and electricity would total some USD 20.5 billion in 2008, about 20% of total GOI spending and outstripping GOI spending on housing, law and order, health and education combined. A further subsidy is provided for the express purpose of increasing grid connections to the poor.

In early April 2008, MEMR announced that the GOI would cease paying subsidies from May 2008 to larger industrial electricity consumers. MEMR estimated that this could save the GOI up to USD 270 million annually. Instituting cost-reflective tariffs for large industrial users is an area where the GOI can make subsidy reductions without causing direct economic hardship for Indonesia's poor.

PT PLN also raises some revenue by issuing bonds. However, recent bond issues have received mixed ratings. This rating is dependent on the GOI guarantee behind these debt instruments. With only a limited ability to raise revenue, issuing bonds will add to overall debt levels and servicing costs for PT PLN.

PT PLN continues to be squeezed between rising costs and below-cost electricity tariffs. Negative cash flows prevent PT PLN from undertaking much needed investment in the electricity sector. PT PLN has not only been unable to meet the cost of installing new generation capacity, but its normal repair and maintenance schedules have also been compromised. This has contributed to the increasing frequency of significant power supply disruptions due to breakdown of generation plant and the transmission and distribution systems.

The unreliability of the electricity system and slow progress against the electrification target has led to frequent public criticisms of PT PLN. Much of this criticism may be unwarranted given the financial and fuel constraints faced by the utility. From an operational perspective, PT PLN has been successful to date in delivering power with a high degree of reliability under difficult circumstances.

INFRASTRUCTURE INVESTMENT

As discussed, although demand has continued to grow, it has not been matched by increases in generation investment. In the period immediately after 1997, only plant that was committed or already under construction was completed. No new investment was undertaken until 2004, and new investment has failed to keep pace with the growth in demand.

The average rate of growth in new capacity between 1997 and 2004 was 4.4%, well under the 7% annual growth rate in demand. Anecdotally, a considerable portion of this supply gap was met by wealthier Indonesians using thousands of 0.5-2 kW Honda stand-by generators.

Table 11.4..... Installed capacity by type (MW)

	PLTA	PLTU	PLTG	PLTGU	PLTP	PLTD	PLTMG	Total	Growth
PT PLN only									
1990	2 095	3 941	1 230	-	140	1 870	-	9 275	-
1991	2 115	3 941	1 214	-	140	1 946	-	9 356	0.9%
1992	2 178	3 941	1 223	1 312	140	2 060	-	10 853	16.0%
1993	2 178	4 691	975	3 411	195	2 119	-	13 569	25.0%
1994	2 178	4 756	1 169	3 942	305	2 164	-	14 514	7.0%
1995	2 180	4 821	1 020	4 413	308	2 228	-	14 970	3.1%
1996	2 184	5 021	1 093	5 053	309	2 449	-	16 109	7.6%
1997	2 436	6 771	1 371	5 589	363	2 416	-	18 946	17.6%
1998	3 007	6 771	1 347	6 561	360	2 535	-	20 581	8.6%
1999	3 014	6 770	1 516	6 282	360	2 650	-	20 592	0.1%
2000	3 015	6 770	1 203	6 863	360	2 550	-	20 762	0.8%
2001	3 106	6 900	1 225	6 863	360	2 585	-	21 039	1.3%
2002	3 155	6 900	1 225	6 863	380	2 589	-	21 112	0.3%
2003	3 168	6 900	1 225	6 863	380	2 671	-	21 206	0.4%
2004	3 199	6 900	1 482	6 561	380	2 933	-	21 455	1.2%
2005	3 221	6 900	2 724	6 281	164	2 982	12	22 284	3.7%
Independent power producers and captive power sold to PT PLN									
1990	834	-	-	-	-	-	-	834	-
1991	976	-	-	-	-	-	-	976	17.1%
1992	1 122	-	-	-	-	-	-	1 122	14.9%
1993	1 177	-	-	-	-	-	-	1 177	4.9%
1994	1 178	-	-	-	-	-	-	1 178	0.1%
1995	1 184	-	-	-	-	-	-	1 184	0.5%
1996	1 182	-	-	150	-	-	-	1 332	12.5%
1997	1 184	-	60	150	165	-	-	1 559	17.0%
1998	1 184	1 200	60	285	165	-	-	2 894	85.6%
1999	1 182	2 400	60	285	165	-	-	4 092	41.4%
2000	1 184	2 400	60	285	345	-	-	4 274	4.4%
2001	1 184	2 400	60	285	345	-	-	4 274	0.0%
2002	1 184	2 400	60	285	405	-	-	4 334	1.4%
2003	1 184	2 400	60	285	427	-	-	4 356	0.5%
2004	1 184	3 965	60	285	472	344	-	6 310	44.8%
2005	1 184	3 965	60	375	692	344	-	6 620	4.9%
Total									
1990	2 929	3 941	1 230	-	140	1 870	-	10 109	-
1991	3 092	3 941	1 214	-	140	1 946	-	10 332	2.2%
1992	3 300	3 941	1 223	1 312	140	2 060	-	11 975	15.9%
1993	3 355	4 691	975	3 411	195	2 119	-	14 746	23.1%
1994	3 356	4 756	1 169	3 942	305	2 164	-	15 692	6.4%
1995	3 364	4 821	1 020	4 413	308	2 228	-	16 154	2.9%
1996	3 366	5 021	1 093	5 203	309	2 449	-	17 441	8.0%

	PLTA	PLTU	PLTG	PLTGU	PLTP	PLTD	PLTMG	Total	Growth
1997	3 620	6 771	1 431	5 739	528	2 416	-	20 505	17.6%
1998	4 191	7 971	1 407	6 846	525	2 535	-	23 475	14.5%
1999	4 196	9 170	1 576	6 567	525	2 650	-	24 684	5.2%
2000	4 199	9 170	1 263	7 148	705	2 550	-	25 036	1.4%
2001	4 290	9 300	1 285	7 148	705	2 585	-	25 313	1.1%
2002	4 339	9 300	1 285	7 148	785	2 589	-	25 446	0.5%
2003	4 352	9 300	1 285	7 148	807	2 671	-	25 562	0.5%
2004	4 383	10 865	1 542	6 846	852	3 277	-	27 765	8.6%
2005	4 405	10 865	2 784	6 656	855	3 326	12	28 903	4.1%

Note: PLTA = Hydro, PLTU = Steam, PLTG = Gas Turbine, PLTGU = Combined cycle (steam), PLTP = Geothermal, PLTD = Diesel, PLTGM = Combined cycle.
Source: Ministry of Energy and Mineral Resources.

The lack of available generation capacity in the main Java-Madura-Bali grid, as well as in systems outside the central system, has been one of the causes of periodic brownouts and blackouts. PT PLN has not been in a position to address the imbalance between supply and demand. To maintain adequate supply to the general population, PT PLN has curtailed supply to industrial users during periods of high demand. Industrial users with their own generation capacity have been obliged to initiate self-generation even when it is at a higher cost than the PT PLN tariff. At the same time, the rate at which PT PLN has added new customers to the grid has considerably slowed.

Electricity consumption is being constrained and system security placed at risk by a lack of investment in generation capacity and supporting infrastructure. Enforced supply cuts mean that there is a considerable volume of unserved demand. Anecdotal advice suggests that the current level of unserved demand would immediately absorb 4 000 MW of additional installed capacity. In addition to this 4 000 MW of unserved demand, further annual capacity additions of about 3 000 MW would be required to meet demand at current growth rates.

Furthermore, the GOI has set an ambitious and laudable electrification target of 93% by 2020 (see later section on rural electrification). PT PLN has sets its own ambitious target of connecting 100% of the population to the grid by 2020.

Chronic under-investment in generation is not the only problem faced by the Indonesian power sector. According to reports, the backbone of the transmission grid across Java requires urgent upgrading to enable it to transport power across the island as well as to improve system security; there have been a number of recent transmission failures that have caused extended blackouts. The ability of PT PLN to carry out much need investment on the transmission system is further impeded by significant land access issues.

Considerable new investment will be required in generation capacity, the electricity supply grid, and other supporting infrastructure such as the fuel supply infrastructure, if there is to be a sustainable improvement in the electrification ratio. PT PLN has estimated that to achieve this objective by 2020, it will require investment in generation and network assets of USD 60 billion.

Table 11.5..... Estimated investment requirements to 2020

Requirements	USD billion
Generating facilities (PT PLN + IPPs)	38.9
Transmission and substations	11.2
Distribution facilities	9.8
Total	59.9

Source: *Opportunities in Indonesia Power Supply Projects,* PT PLN, 2007.

GOVERNMENT POLICY RESPONSE

The GOI was quick to acknowledge, in the immediate aftermath of the Asian financial crisis, the significant challenges it faced in meeting the power generation needs of the country. In August 1998, the GOI released a white paper that outlined key proposed reforms in the electricity industry.

The intended reforms were introduced under a new Electricity Law No. 20/2002 to replace the existing Law No. 15/1985, namely:

- industry restructuring;
- introduction of competition;
- introduction of a tariff regime based on full cost recovery;
- improving rational private participation;
- redefinition of the government role; and
- strengthening the legal and regulatory framework and the establishment of an independent regulatory body with effective mechanisms for dispute resolution.

The new Electricity Law was annulled by the Constitutional Court in December 2004. The provisions for a competitive electricity market and unbundling of PT PLN were ruled as unconstitutional by the court and the Electricity Law No. 15/1985 was re-enacted.

To address the uncertainty caused by the annulment of the new Electricity Law by the Constitutional Court, Governmental Regulation No. 3/2005 was issued. It included most of the provisions stated in Electricity Law No. 20/2002 with the exception of the provision of competitive electricity markets, the unbundling of PT PLN and the establishment of an independent electricity regulator.

Under the reinstated Law No. 15/1985, PT PLN is the single license holder for public electricity provision in Indonesia. Private-sector participation is recognised, but limited to generation. Subsequent to the annulment of the Electricity Law No. 20/2002, ministerial decrees were issued that allowed PT PLN to purchase electricity from private producers.

The uncertainty in the regulatory climate following the failure of the new Electricity Law has been another factor that has weakened the investment climate for the power sector. The GOI has sought to address some of the uncertainty that was created

after the new Electricity Law was overturned, with the passage of a new Energy Law No. 30/2007 of August 2007.

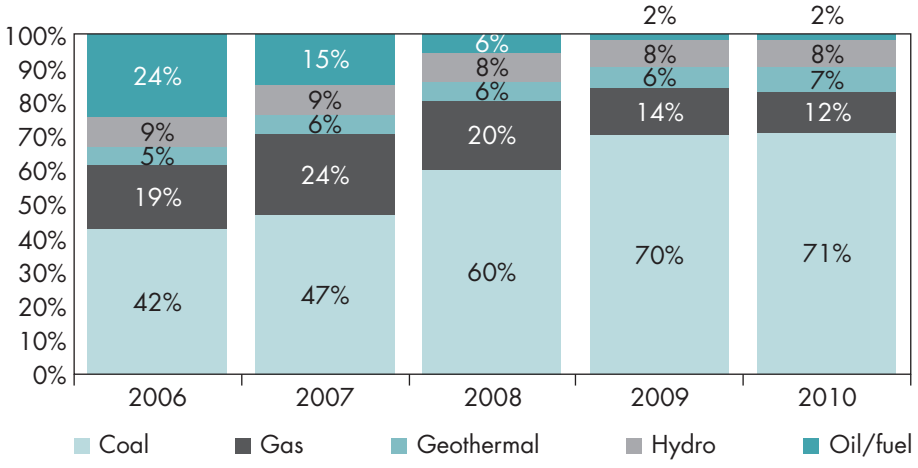
Electricity Fast Track/"Crash" Programme

To address the increasingly critical need for investment in the electricity sector and to meet the longer term power requirements of the economy, the GOI has embarked upon an ambitious programme to expand generation capacity. The plan, known as the 10 000 MW Electricity Fast Track (or "Crash") Programme, aims to add 10 000 MW of new capacity by 2010.

PT PLN has prepared numerous detailed proposals for new power plant projects, which it has offered to investors as part of the 10 000 MW "Crash" Programme. The programme calls for 10 projects totalling 6 900 MW to be located on Java-Madura-Bali and 25 others outside Java totalling 3 100 MW. The GOI has expressed a desire to see a similar level of new capacity installed by the private sector.

The Fast Track Programme seeks to promote coal-fired and natural gas-fired power stations to reduce Indonesia's domestic dependence on the consumption of oil. By reducing the overall dependence on oil, the savings in fuel costs is anticipated to translate into large operating cost reductions for PT PLN and a reduction in the size of the annual subsidy provided by the GOI to PT PLN. The GOI has specified that the maximum selling price to PT PLN of power generated under the programme is no more than USD 4.9 cents per kWh.

Figure 11.3 ..... Planned fuel mix share (Java-Madura-Bali system) under the Fast Track Programme



Source: Ministry of Energy and Mineral Resources.

Question marks remain over the capacity of the GOI to deliver this highly ambitious plan. An initial hurdle faced by the GOI was the refusal of parties tendering under

the Fast Track Programme to enter into financing arrangements with PT PLN. These prospective investors were wary of the experience of counterparties to power purchase arrangements with PT PLN following the Asian financial crisis. They were also wary of the financial position of PT PLN in light of tariff settings, and, until recently, some uncertainty due to delays in the passage of the new Energy Law.

Potential investors refused to accept assurances of non-default by PT PLN and requested guarantee payments to the infrastructure suppliers. The GOI initially rejected these calls on the basis that its policy was not to give guarantees and asked that they be sought from PT PLN. This led to a standoff and some delay to the initial timetable for the Fast Track Programme. Preliminary data for years 2007 and 2008 point to a much higher than hoped for consumption of oil while coal and gas firing were lower than planned.

The GOI has since relented and project planning is now well advanced, with tendering for most of the projects now complete. The GOI is to be commended for its ability to harness and co-ordinate relevant arms of the government and PT PLN to deliver the Fast Track Programme and address the critical immediate power supply need of the economy.

Nevertheless, the arrangement is not without its risks as it exposes the GOI to external economic shocks that may again raise the servicing costs of contracts entered into under the Fast Track Programme.

Investment, costs and the electricity tariff

A key problem facing the Indonesia power sector is underinvestment. A lack of investment is reflected in the low electrification rate (discussed more fully in the next section), inadequate supply to meet demand, deteriorating facilities and equipment, and poor and intermittent service quality.

There are three broad options for obtaining the required investment funds to address this situation:

- from domestic utilities, supported by semi-official borrowings, and underpinned by reliable income flows from consumer revenues;
- direct private-sector financing (possibly with the support of aid agencies), who will seek an economic return on those investments; and
- budget financing, supplied either directly or through subsidies provided by the GOI.

The overwhelming impediment to the first two investment options is the GOI tariff pricing policy which greatly constrains PT PLN in its ability to make new investments, expand its services or, even, efficiently maintain existing services. In spite of this, the GOI has not found it politically acceptable to establish pricing policies that are more cost reflective: in July 2007, the GOI ruled out any increase in the tariffs until after

the 2009 elections. As discussed earlier, this has forced the GOI to underwrite the power sector through direct budget financing.

This is only sustainable as long as the GOI is able to continue to provide the financing. The current level of financing required has lead to serious structural imbalances in the budget, drawing funds away from other urgent priorities. These inefficient arrangements have constrained domestic growth and discouraged foreign investment.

There are two ways in which this disparity can be addressed, namely by lowering costs and by raising tariffs. It is difficult to gauge the extent to which the 10 000 MW Fast Track Programme will address the disparity between power costs and the charges to end-use customers.

The extent to which overall electricity production costs decline under the Fast Track Programme from a substitution of inexpensive coal-fired generation for expensive oil-fired generation is not clear. There is little doubt that the Fast Track Programme will lead to a reduction in average electricity production costs. However, if the costs of production remain higher than the revenue generated from the subsidised tariffs, then the Fast Track Programme will simply continue to exacerbate demands on the Government budget.

A positive aspect of the Fast Track Programme is the construction of mine-mouth power stations in Sumatra that will export power to near northern neighbours, such as Singapore and Malaysia. This can reasonably be expected to be an important revenue source to national income.

Infrastructure and coal supply issues

The Fast Track Programme has been designed to maximise the utilisation of low-rank, 4 200 kcal coal. This policy has some important benefits. The low value of the coal will enable power generation costs to be reduced, it will leave higher quality coal available for export, and it maximises the use of Indonesia coal resources.

The success of the Fast Track Programme is dependent on a significant increase in coal production. Review Team discussions indicated that a number of the tenders to supply coal to the new power plants have been won by coal companies that are yet to enter into production and have not yet invested in the necessary production and transportation facilities. To facilitate the required coal mine development, policy impediments in this area require urgent resolution.

Coal transport remains a significant problem in Indonesia. For the most part, Indonesia's coal resources are located in Sumatra and Kalimantan, away from the main demand centre of Java-Madura-Bali. Consequently, the transport of large tonnages of high moisture, low-rank coal will inflate power production costs and, in many cases, may not be economic. The promotion of mine-mouth power generation, particularly in areas of rapid growth in industrial and human settlement (*e.g.* south Sumatra), avoids this issue.

But dependence on mine-mouth power generation has its limits. The transmission of power between the main islands requires significant logistical and technical problems to be addressed. The geologically active nature of the region, the risk to power cables from shipping, and land access for transmission easements must all be overcome.

Significant transport bottlenecks also exist. A large proportion of the coal sourced from central Kalimantan is transported by barge along river systems, which, in the dry season, can halt deliveries. In other areas, the capacity of domestic rail systems (track and rolling stock) for coal transport is inadequate and represents a significant bottleneck. For example, in South Sumatra, deliveries are limited by the single 420 kilometres stretch of rail line that has a maximum capacity of only 14 million tonnes per year.

Further compounding the coal transport problem is the cabotage policy that demands the use of Indonesian flag vessels for domestic waters shipping. Such vessels are frequently in short supply and exacerbate the problem of timely coal deliveries.

The success of the Fast Track Programme risks being undermined by unreliable coal supply due to a lack of critical transport infrastructure. More investment is needed in rail, port, barge, terminal, and loading and unloading facilities if coal supply reliability is to be improved. This risk was borne out in March 2008 when unseasonable weather prevented adequate coal shipments reaching domestic markets, causing stocks to fall to a few days and blackouts through the Java-Madura-Bali system.

The Fast Track Programme is not limited to coal-fired generation plants; it includes projects that aim to significantly expand gas-fired generation. However, PT PLN is already in a position where it is unable to source gas to supply its existing gas generators. PT PLN has issued tenders for the supply of gas, but has not received any offers: access to gas at the present time is not just an issue of price but one of availability.

Due to limited investment in upstream oil and gas exploration and production, Indonesia's gas production is declining and there is a supply-demand mismatch both for current LNG contractual commitments and domestic demand. Limits in Indonesia's gas transmission infrastructure also mean that Indonesia's gas cannot always get to potential domestic markets. The GOI has stated that gas policy sets domestic demand as a priority over export contracts and, to address the pipeline infrastructure problems, PT PLN is giving consideration to the construction of an LNG receiving facility in Java (see the Downstream Gas chapter).

There are two concerns with the current situation. The first is that without access to reliable long-term gas supply, it is doubtful the gas generation projects identified in the Fast Track Programme will proceed. Furthermore, any power system requires some generation capacity with rapid start-up rates to respond to fluctuations in demand in order to manage voltage and frequency control and maintain power system security. The lack of gas as a fuel places much heavier reliance upon hydro-electric facilities to meet this need. During the dry season, when the demands on the power system are greatest, reduced water availability increases risks to power system security.

Addressing the recommendations related to gas elsewhere in this report should be a priority. It will not be possible to overcome the gas shortage in the short term given the long lead times for the construction of gas production and transportation facilities. This emphasises the need for urgent action in this area.

To compound these issues still further, it became clear during Review Team discussions that one of the first casualties of the financial difficulties faced by PT PLN has been its maintenance programme. Indications are that PT PLN has been unable to meet the normal operation and maintenance schedule requirements on its installed plant; without the ability to purchase spare parts and address routine maintenance needs, reliability and security of the supply system are compromised.

Impact on the scope for power generation diversification

Indonesia has the opportunity to diversify its high voltage grid-connected power generation away from a high reliance on fossil fuels. In 2005, Indonesia generated 10.8 TWh of electricity from hydropower, representing more than 8% of total generation. Indonesia holds vast hydropower potential, but the country has yet to invest in large hydropower facilities as seen elsewhere in Asia. Hydropower plants require large upfront capital investment and PT PLN does not have the financial resources in the near term.

Indonesia generated 6.6 TWh of electricity from geothermal and other renewable sources in 2005, making up over 5% of total generation. Indonesia has more than 1 090 MW of geothermal capacity, making it the fourth largest producer of geothermal power in the world behind the United States, the Philippines and Mexico. The GOI estimates that Indonesia has the potential to supply up to 21 GW of additional geothermal capacity.

The heavily subsidised tariffs hamper investment and several plans for large-scale geothermal development projects were scrapped following the Asian financial crisis.

Addressing electricity tariffs

Tariff reform is the most significant task facing the GOI in the power sector. The main cause of the deteriorating performance in the power sector is underinvestment, due largely to the GOI's failure to institute cost-reflective tariffs. In the absence of cost-reflective tariffs, the private sector will not invest without guarantees or other generous forms of support from government.

The rationale for maintaining the subsidised tariffs is to ensure that essential services remain affordable to poorer communities. However, Indonesia's tariff arrangements do not differentiate between rich and poor, and the rich reap greater benefit because they consume more. Additionally, poor communities, particularly remote rural communities, often have very limited or no access to grid-connected electricity and,

hence, capture only a small fraction of any subsidised service. The subsidised tariffs also undermine the financial ability of PT PLN to extend and best maintain its service to the poorer communities, directly contrary to their intended effect.

Research by the World Bank and others has shown that the negative impacts of upwards tariff adjustments are more than offset by improvements in service quality, increased access for the poor, and improvements to the structure of public finances that most benefit the poor. Taxation and targeted government expenditure to support social goals create fewer distortions than subsidies.

As discussed in the Downstream Oil chapter, the GOI has undertaken major petroleum subsidy reductions in October 2005 and, recently, in May 2008. As part of the consequent compensation package to the poor, the GOI instituted a direct payments delivery system to the poor for a determined period of monthly payments. Anecdotal discussions point to continuing problems with the payments' delivery but that it is, by and large, proving effective.

The Review recognises that, in the absence of an efficient income taxation system and proven administrative systems to deliver direct benefits to the poor, reliance on some form of more effectively targeted subsidy will be necessary. Where feasible, more effective alternatives to country-wide subsidised tariffs are:

- direct payments to disadvantaged groups through targeted connection subsidies; and
- subsidised tariffs based on location or housing characteristics.

These mechanisms are transparent, explicit, and reduce distortions in consumer behaviour.

Managing the transition to cost-reflective tariffs is socially and politically difficult. In general, tariff adjustments should be determined by the prevailing economic situation. The approach needs to take into consideration the interests of consumers as well as the power service providers. Ideally, the upward adjustment should fall above the rate of inflation and below the rate of economic growth. In this way, price adjustments are economically affordable. Where on this scale the adjustment should fall also depends on the desired period of transition to cost-reflective tariffs and any reduction in operating costs plus other efficiency gains. A clear timetable for the staged tariff increases and a public awareness campaign of the increases and their costs and benefits, should be put in place well before any increase.

Responsibility for tariff setting should be given to an independent body that is competent, non-political and professional, and possesses the correct economic and regulatory experience. The body must also be subject to procedural requirements to ensure integrity, transparency, independence and accountability of decision making. While recognising the Constitutional Court's decision on the Electricity Law of 2002, there remains the imperative to complete the separation of policy, regulation and operational functions in the electricity sector in the medium term and establish an independent and empowered electricity regulator.

RURAL ELECTRIFICATION

Electrification rates

Rural electrification is a key priority of the GOI and, in spite of difficult geographical and financial barriers, Indonesia continues to make measured progress towards providing access to electricity to the majority of its rural population. Though exact data on the rural electrification rate are not available, estimates suggest that 55-70% of the population has access to electricity in their home, while 85% of villages have some access to electricity. On a regional basis, the electrification rate varies from below 22% in very isolated areas to over 99% in the urban centres of Java.

Reported electrification rates vary somewhat, with PT PLN reporting lower rates. Overall, Indonesia's electrification rate is below that of most countries in the region, including Malaysia (98%), Thailand (99%), Vietnam (84%) and the Philippines (81%).[19]

Table 11.6..... Electrification rate by island, 2006

Island	Population (million)	Electrification rate	Population without access (million)
Java	130.0	64%	46.8
Bali	3.4	71%	0.99
Sumatra	46.9	52%	22.5
Kalimantan	12.3	53%	5.8
Sulawesi	16.1	47%	8.5
Nusa Tenggara	8.6	26%	6.4
Maluku	2.2	52%	1.1
Papua	2.7	28%	1.9
Total	223.0	59%	94.0

Source: Ministry of Energy and Mineral Resources.

Electrification targets

The IEA is pleased to see that Indonesia has set a bold target to bring electricity access to 93% of its population by 2020. The national electricity company, PT PLN, has set an even bolder target of 100% by 2020. Access to electricity helps bring the poor out of poverty and contributes to sustained and sustainable economic growth.

19. *2007-08 Electrification Rates,* UNDP Human Development Report, http://hdrstats.undp.org/indicators/210.html.

The lack of a unified land, low population densities in many areas, and low average consumption per capita makes economies of scale difficult to achieve in Indonesia, and, currently, there is no incentive in place to make connections to the grid where they are uneconomic. Consequently, the targets will require steady and continuous connections over the next decade if they are to be achieved. To meet this very challenging target, we urge the GOI to set specific milestones to ensure that its target is being met over time.

Incentives to expand rural electrification

Bringing electricity to the majority of Indonesia's rural population will rely on two separate methods: connecting rural areas to the integrated electricity grid or establishing distributed, small-scale power sources. The current distorted payment structure to PT PLN and its monopoly presence in Indonesia's isolated regions does not provide it with the signals to necessarily make sound analysis of least-cost supply options.

The Review Team suggests that independent analysis conducted by the Government is necessary to determine how rural communities receive electricity, free from the influence of particular stakeholders. This may be an appropriate role for the independent electricity regulatory body, as outlined in the previous section.

An independent regulatory body would have the obligation to undertake cost-effectiveness evaluations that would determine the least-cost means of providing reliable electricity, taking into account the benefits of enhanced integration on the overall efficient management and operation of the electricity grid. The calculation would not, however, take into account general benefits to the electricity company of increased subsidies for grid interconnections versus subsidies directed elsewhere for off-grid systems.

In terms of achieving Indonesia's rural electrification targets, an underlying issue is the lack of proper incentives and accounting for the implementing entity, PT PLN, to use GOI funds to cover the costs of its public service obligation to rural electrification targets. The GOI provided about USD 250 million in 2005 in payments to PT PLN to compensate it for making new grid and off-grid connections in rural areas. However, the funds are provided with minimal oversight and auditing and it is not clear as to whether connections were made commensurate with the payments provided or what type of supply systems were connected.

International experience has shown that an effective way to ensure sustainable electrification in rural areas is to give the rural communities a stake in the process, along with commensurate responsibilities and accountability. Funds for their rural electrification should then be channelled through local governments and communities, rather than through PT PLN.

To spur investment from the private sector, the government must ensure that the rural electrification programme has clarity, flexibility, and sustainability. Flexibility and sustainability will recognise that implementation in a particular region will have its own

specific issues that will require constant analysis and modifications to accommodate to that particular region. Such programme continuity should not inhibit necessary flexibility. The Government should continuously undertake trials and evaluate the effectiveness of programmes to ensure that they achieve their maximum potential over the medium and long term.

A further issue to build into the rural electrification programme is the need for incentives to provide long-term maintenance and efficient operation of these systems. As discussed in the Renewable Energy chapter, the government would provide sufficient training and incentives to enable their effective administration, operation and maintenance of their off-grid electricity systems.

Conclusions and recommendations

The GOI is keen to address the current low electrification rate and has set an ambitious and laudable electrification target of 93% by 2020. However, Indonesia continues to have brownouts and blackouts on the main Java-Madura-Bali integrated grid and in the smaller systems on the other main islands. The cause of these system breakdowns is transmission system failures, breakdown of generation plant, fuel supply disruptions and demand exceeding the system capacity.

The electricity system in Indonesia has suffered from a lack of adequate investment, particularly since the Asian financial crisis of 1997-99. The ability of PT PLN to fund much needed investment (and its ongoing electrification targets) is constrained by the highly subsidised electricity tariffs that requires PT PLN to sell at below its costs of production. In this situation, even routine maintenance will suffer. Other countries in Southeast Asia have confronted similar difficulties in the past and have succeeded in achieving high electrification rates with high quality of electricity supply. A comparative study of the Indonesian tariff system with that of Thailand's tariff system may provide useful insights.

The non-cost reflective tariff is a key factor deterring foreign investment in Indonesia's power sector. Investment will be unlikely to take place, whether it is direct or through an independent power producer (IPP), without commitments on the part of the GOI and/or PT PLN to underwrite or otherwise guarantee the investment.

The decision of the Constitutional Court to annul the new Electricity Law No. 20/2002 further served to undermine investor confidence and there is an overwhelming need to restore credible government power sector policy and its rational implementation. Some form of independent and transparent regulatory body is required.

Though exact data on the rate of rural electrification are not available, estimates suggest that 85% of villages have some access to electricity. However, on a regional basis, the electrification rate varies from below 25% in very isolated areas to over 99% in built-up centres. Access to electricity helps bring the poor out of poverty and contributes to sustained and sustainable economic growth for all of Indonesia.

In terms of achieving the rural electrification target, it is unclear whether the GOI annual subsidises to PT PLN are used for rural electrification connections as intended. Funds for rural electrification should be channelled through local governments and communities, rather than indirectly through PT PLN.

Who to connect and how to best provide electricity to Indonesia's rural population requires sound, independent economic analysis and the close involvement of the rural community under consideration. This may be an appropriate role for the independent electricity regulatory body.

The IEA Review Team recommends that the Government of Indonesia:

- Undertake a comparative study of the Indonesian electricity tariff system with that of a country in Southeast Asia such as Thailand that has achieved high quality national electricity supply and high rates of electrification in both urban and rural areas.
- Develop and implement staged increases in electricity tariffs to achieve cost-reflective tariffs by 2012, while:
  - providing direct assistance for the most vulnerable customers during the transition to higher prices, based on, say, location or housing characteristics; and
  - providing a connection subsidy to poor customers that would otherwise be unable to pay for grid connection.
- Establish a high level working group to rapidly develop a roadmap for the creation of an expert, independent and non-political electricity regulatory body within a constitutionally acceptable government framework with initial priorities of:
  - determining the tariff transition path to cost-reflective tariffs by 2012; and
  - assuming responsibility from PT PLN for conducting independent analysis of the most cost-effective means of achieving the electrification targets, including analysis of on- and off-grid electrification options, funding mechanisms, private-sector investment and rural community involvement.
- Provide local governments and communities in rural areas with direct funding and more autonomy for their rural electrification programmes, subsequent to:
  - establishing and enforcing commensurate responsibilities and accountability; and
  - providing sufficient training and incentives to enable their effective administration, operation and maintenance of off-grid electricity systems.
- Continuously monitor and evaluate the effectiveness of rural electrification programmes to ensure that they achieve their maximum potential over the medium and long term.

XII. NUCLEAR POWER

This chapter seeks to consider, from an energy policy viewpoint, the Government of Indonesia's (GOI) nuclear power policies, institutions and regulatory framework, and their ability to manage the introduction, safe operation, waste management and subsequent decommissioning of the proposed nuclear power programme in Indonesia. A thorough technical and financial assessment of all aspects of safety, waste management, funding, investment, etc., is not included as it is not within the realm of this energy policy review.

Indonesia became a Member State of the International Atomic Energy Agency (IAEA) in 1957 and has been an active participant in its Technical Co-operation (TC) Programme since then. This chapter draws extensively on the "Country Nuclear Power Profile: Indonesia 2003", Division of Nuclear Power of the Department of Nuclear Energy, IAEA.

ORGANISATION OF NATIONAL NUCLEAR PROGRAMME

Nuclear activity in Indonesia began with the establishment in 1954 of the State Committee for the Investigation of Radioactivity, which investigated the possibility of radioactive fall-out in Indonesia territory from the nuclear weapon tests in the Pacific Ocean. Noting that the development and application of atomic energy could enhance the welfare of the people, the GOI issued Governmental Regulation No. 65/1958 establishing the Atomic Energy Council and the Atomic Energy Institute.

This was later followed by the enactment of Law No. 31/1964 regarding the Basic Stipulations on Atomic Energy and the Governmental Regulation No. 33/1965 which also renamed the Atomic Energy Institute into the National Atomic Energy Agency (Badan Tenaga Atom National or BATAN). In order to improve mastery of nuclear science and technology, several research and development and engineering facilities were built; among these are the Bandung Nuclear Complex (1965), the Pasar Jumat Nuclear Complex (1966), the Yogyakarta Nuclear Complex (1967) and the Serpong Nuclear Complex (1987).

An effective nuclear regulatory authority and a predictable and transparent regulatory and licensing framework are required to proceed with the development of a nuclear power sector. The GOI issued the Law No. 10/1997 on the Basic Provision of Nuclear Energy, which stipulated among others the separation of the executing function on the beneficial applications of nuclear energy (BATAN) from the regulatory function. The regulatory function was to be held by a new Nuclear Energy Regulatory Agency (Badan Pengawas Tenaga Nuklir or BAPETEN).

BAPETEN was established in April 1998 (President Decree No. 76/1998). It is responsible for regulating and controlling the use of radioactive materials, radiation sources, nuclear reactors and nuclear materials in Indonesia. BAPETEN, as an independent regulatory body, has responsibility to ensure that any activity related to the use of nuclear energy is obligated to maintain safety, security, and peace, as well as the health of the workers and the public, and the protection of the environment.

In accordance with Law No. 10/1997 on Nuclear Energy and the latest Presidential Decree No. 64/2005, BATAN has been stipulated as a non-Departmental Government Institution which is responsible to the President. BATAN's programme is under the co-ordination of the Minister of Research and Technology. The main duties of BATAN are to conduct government activities in the field of research, development, and the beneficial application of nuclear energy in accordance with its laws and regulations.

STATUS OF NUCLEAR POWER PROGRAMME

In 1972, the Commission for Construction Preparation of Nuclear Power Plant initiated a programme for introducing nuclear power in Indonesia. Site selection was conducted in several places on Java and potential sites on Muria Peninsula, north coast of Java, were recommended.

The first feasibility study for the introduction of nuclear power plant (NPP) was conducted in 1978 with the assistance of the Government of Italy. However, following this study, the GOI deferred the decision until the BATAN nuclear research facilities in Serpong became fully operational.

In 1985, work began on updating the studies with the assistance of the International Atomic Energy Agency (IAEA), USA, France and Italy. These updated reports, and the analytical capabilities developed by the Indonesian partners during the process of this co-operation, have become the foundation for the current planning activities.

In September 1989, the GOI, through the National Energy Co-ordination Board (BAKOREN), decided to undertake a new NPP feasibility study including comprehensive investigation of the Muria Peninsula as a candidate site for NPPs. The study was carried out by BATAN, under the direction of the Energy Technical Committee (PTE) of the Ministry of Energy and Mineral Resources (MEMR) and other institutions.

In August 1991, an agreement was signed in Jakarta between the Indonesian Ministry of Finance and BATAN on behalf of the GOI, and the consultants NEWJEC Inc. This agreement contracted NEWJEC for a 4.5 year period to perform a site selection and evaluation, and a comprehensive NPP feasibility study for a 7000 MWe plant.

The first two phases were performed during 1992 and 1993 and three candidate sites (Ujung Lemah Abang, Ujung Grenggengan and Ujung Watu) on the northern coast of the Muria Peninsula in Central Java were compared and ranked. At the conclusion of

the studies in 1995, the "preferred candidate site", Ujung Lemahabang, was evaluated to confirm its acceptability.

In May 1996, the feasibility study for the first NPP in Indonesia was completed. The results of the feasibility study showed that the introduction of NPPs in the early 2000s to the Java-Bali system represented an optimal solution.

After the feasibility study, other studies were done, including the preparation of bid invitation specification, development of financing, re-evaluation of nuclear energy for electricity planning and further study of the Muria site. BATAN collected basic on-site data of Muria Peninsula that is required for a Site Evaluation Report, but detailed site investigation for construction design of foundations is still required. BATAN also continued to perform research and development activities including reactor safety, radiation protection, fuel and radioactive waste treatment.

Nuclear power in national energy planning

Following the 1997-98 Asian financial crisis, a re-evaluation study on long-term electricity planning was undertaken. Completed in 2002, the study, "Comprehensive Assessment of Different Energy Sources for Electricity Generation in Indonesia", was prepared by a team of experts from BATAN, BPPT and MEMR. The International Atomic Energy Agency (IAEA) assisted the GOI in executing this study by giving aid in the form of computer software and assistance from its experts.

The study's objective was to support the national planning and decision-making process in Indonesia's energy and electricity sectors, taking into account key economic, environmental and social aspects. The study was intended to comprehensively assess the potential contribution of various energy sources to the optimal long-term development of Indonesia's energy and demand up to 2025, consistent with sustainable development.

The study found that nuclear power is the third principal generation option (behind gas and coal). There are no real technical infrastructure constraints or limiting interdependencies with other sub-sectors of the energy system that would prevent its introduction. Nuclear power plants can be added to the system when increased demand requires new capacity or if reality unfolds differently from the scenarios underlying the study.

The study took as its basic hypothesis that the introduction of NPP into the Java-Bali electricity grid would be possible in 2016 for 2 GWe; this required the decision on the nuclear option being taken in 2004-2005, and then construction starting in 2010. Nuclear capacity would then reach more than 6-7 GWe by 2025, using proven reactor LWR1000 (1000 MWe).

To meet Indonesia's power demand in the 21st century in a sustainable manner, it will require the large-scale deployment of energy sources, with NPP as one of many options. To guide NPP development, Presidential Regulation No. 5/2006 was enacted,

with the share of new and renewable energy including biomass, nuclear, hydro, solar and wind in the national energy mix to reach more than 5% in the year 2025. The introduction of nuclear power plant in Indonesia is not only to achieve an optimal energy mix (for the Java-Madura-Bali electricity grid) based on costs and environmental protection, but also to relieve the pressure arising from increasing domestic demand for oil and gas and to support sustainable energy development in Indonesia.

In line with Law No. 17/2007 on National Long-Term Development Planning Year 2005-2025, nuclear electricity generation should commence operation in Indonesia between years 2015-2019. Taking into account the time needed for permitting and licensing, construction of the first NPP unit should start around 2010. The licensing process for the site and for construction permits will take two to three years. As the preparations of licence applications will take a minimum of one to two years, commissioning of the first unit is already delayed by several years.

Discussions with the Ministry of Energy and Mineral Resources indicated that, for the medium and the long term, the GOI is considering and planning towards possible NPP. Discussions also indicated that the President plans to nominate a special committee to prepare and co-ordinate the possible construction of NPP.

Ownership of NPP

Based on Article 13(3) of the Law No. 10/1997 on Nuclear Energy, the commercial construction, operation and decommissioning of nuclear reactor shall be performed by a state company, co-operative and/or private company. Key issues for private sector involvement will be confidence in a predictable electricity sector and NPP regulatory framework.

The ownership and management of Indonesia's NPP will be determined by the financing conditions for the NPP development. For the conventional financing scheme, the NPP owner will be a state-owned company, and, therefore, the GOI will designate the organisation that will own and operate the NPP. There is still a possibility that the state-owned national electricity company, PT PLN, will act as the utility.

Public perception and acceptance

Two key issues for the introduction of nuclear power are public perception and acceptance. The GOI recognises that these issues concern not just the Indonesian community but also Indonesia's regional neighbours. Accurate and justifiable information on benefits and risks of nuclear power must be provided to the public and a continuing and effective public information and education programme must be pursued to enhance the public perception of nuclear technology.

Both BAPETEN and BATAN have their own activities to provide information. BATAN established a programme for public education and public information on

nuclear technology in co-operation with institutions and universities in Indonesia. Examples include:

- Presentations before the House of Representatives, local and central government;
- Presentations before mass media;
- Training courses for lecturers and teachers;
- Short training courses for students; and
- Public information through newspaper, radio and television.

THE NATIONAL ATOMIC ENERGY AGENCY (BATAN)

The National Atomic Energy Agency (BATAN) is a non-Departmental Government Institution, responsible to the President and under the co-ordination of the Minister of Research and Technology. Its main duties are to conduct government activities in the field of research, development, and the beneficial application of nuclear energy in accordance with its laws and regulations.

Nuclear research facilities

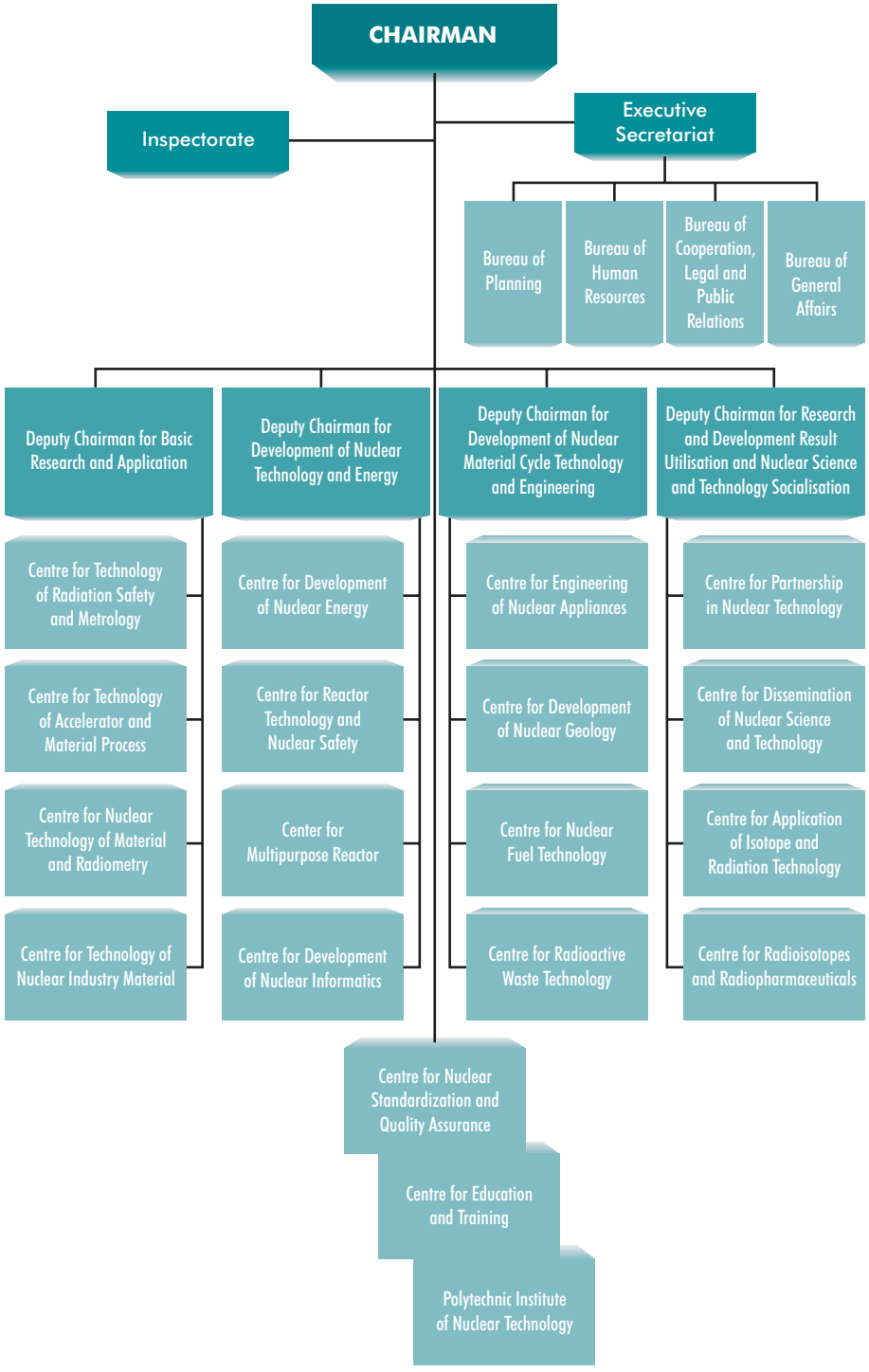
In order to conduct research, development and engineering as well as activities in nuclear science and technology, BATAN has a number of research facilities:

- Serpong Nuclear Complex, Banten, Jakarta;
- Bandung Nuclear Complex, Bandung;
- Yogyakarta Nuclear Complex, Yogyakarta;
- Pasar Jumat Nuclear Complex, Jakarta;
- Monitoring Station for Micro Earthquake and Meteorology in Ujung Watu, Jepara; and
- Uranium Mining Exploration Research Unit in Kalan, West Kalimantan.

The Serpong Nuclear Complex consists of centres for research, development and engineering of nuclear science and technology, and was built to support development of the nuclear industry and the operation of NPP in Indonesia. The main facilities in the Serpong area are the:

- GA Siwabessy Multipurpose Research Reactor 30 MW (established in 1992);
- Installation for Production of Research Reactor Fuel Element;
- Radioisotopes and Radiopharmaceuticals Installation;
- Experimental Fuel Element Installation;
- Radioactive Waste Processing Installation;
- Radioactive Metallurgy Installation;
- Reactor Safety and Engineering Installation;
- Facility for Development of Informatics and Computation;
- Nuclear Mechano Electronic Installation;
- Neutron Spectrometry Installation; and
- Storage for Spent Fuel Element and Contaminated Materials Installation.

Figure 12.1 ..... Organisation of the National Atomic Energy Agency



Source: BATAN.

The Yogyakarta Nuclear Complex was established in 1974, and conducts R&D in nuclear physics, chemistry, technology of low- and medium-energy particle accelerators, processed technology, analysis of nuclear materials and reactors, as well as the use of

the reactor for research and fostering of expertise. The facilities are TRIGA MARK Research Reactor 100 kW, some laboratory for material research, an accelerator, laboratories for nuclear physics and chemistry and a facility for training.

The Bandung Nuclear Complex was constructed in early 1960s and is the first nuclear research reactor in Indonesia. The facility is the TRIGA Mark II 25 kW, first operated in 1965. Its power was increased to 1000 kW in 1971 and to 2000 kW in 2000.

The Pasar Jumat Nuclear Complex was built in 1966. Located in this complex are the Centre for Application of Isotope and Radiation Technology, the Centre for Technology Radiation Safety and Metrology, the Centre for Development of Nuclear Geology, the Centre for Education and Training, and the Centre for Dissemination of Nuclear Science and technology. Its research activities include R&D in radioisotopes and radiation, as well as their application in various fields, R&D in exploration and processing of nuclear materials, geology and geophysics, R&D in radiation safety and nuclear biomedicine, and education and training. A further focus is public information and dissemination of the results of BATAN R&D and engineering in nuclear science and technology to the Indonesian community.

Human resource development

Manpower development for the design, construction, installation and safe operation of NPP is key to a country's NPP programme. Education and training of sufficient number of personnel specialized in operational safety and regulatory aspects of the NPP, project engineering and management, operations and operation management are essential.

The Ministry of Energy and Mineral Resources, BATAN and other stake-holders have initiatives to develop the national human resource programme in order to fulfil the requirements of personnel in each stage of NPP construction and operation, qualitatively and quantitatively (education, experience, and training).

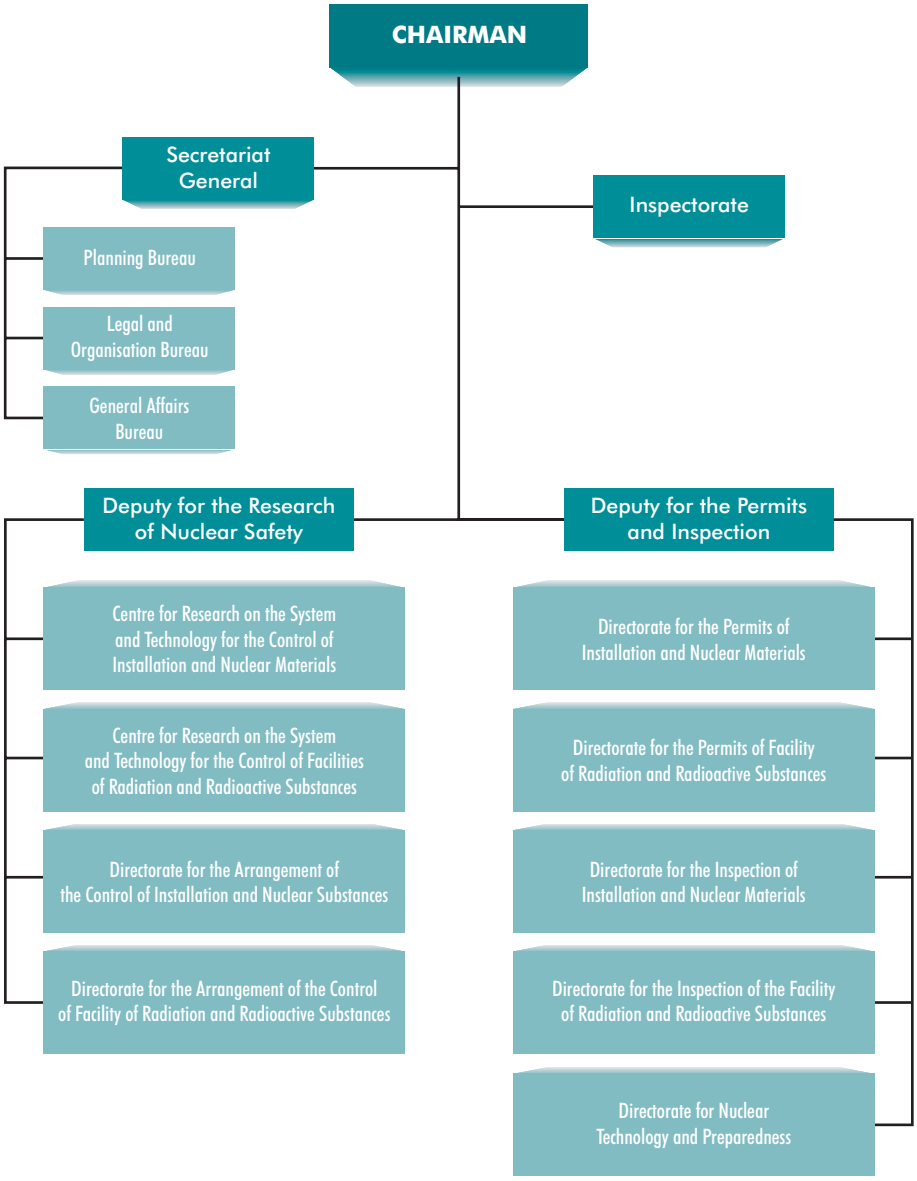
National infrastructures in education and training should be promoted and utilized optimally. Some universities, such as University of Gadjah Mada, Bandung Institute of Technology, and Polytechnique Institutes of Nuclear Technology (PoINT-Batan), offer education programmes on nuclear technology. The Centre for Education and Training of BATAN has many years' experience in conducting training in nuclear technology and nuclear safety for BATAN staff and the public.

THE NUCLEAR ENERGY REGULATORY AGENCY (BAPETEN)

An effective nuclear regulatory authority and a predictable and transparent regulatory and licensing framework are required to proceed with the development of a nuclear power sector. The Nuclear Energy Regulatory Agency (BAPETEN) controls the use of the nuclear material and nuclear reactors in Indonesia. As an independent regulatory body, BAPETEN has responsibility to ensure that any

activity related to the use of nuclear energy is obligated to maintain safety, security, and peace, as well as the health of the industry's workers and the public, and the protection of the environment.

Figure 12.2 ..... Organisation of the Nuclear Energy Regulatory Agency



Source: BAPETEN.

BAPETEN administers this by:

- Drafting and establishing nuclear safety regulations;
- Controlling nuclear installations and nuclear materials through licensing and inspection systems that cover all stages of NPP establishment (from site selection to decommissioning stages); and

- Controlling the use of radioactive materials and other radiation sources through licensing and inspection systems.

Nuclear power plant licensing

Based on Governmental Regulation No. 43/2006, the construction and operation of a nuclear reactor can be undertaken after approval has been issued by BAPETEN. Approval will be issued in stages: Site Permit, Construction Permit, Operating License, and Decommissioning Permit. BAPETEN has been creating the regulatory framework for NPP licensing using the IAEA Nuclear Safety Standards as a basis and adapting them to local conditions using the experience gained in other countries with similar seismic conditions, most notably Japan.

Evaluation of application of each stage is carried out within a certain period: 12 months for Site Permit, 24 months for Construction Permit, 18 months for Operating License, and 12 months for Decommissioning Permit. During the period of evaluation, BAPETEN can ask the applicant to provide additional information on the proposed installation as deemed necessary.

The length of time required for the licensing process is notable, but the GOI may revise the draft, for example, to shorten the time required and to provide greater flexibility, such as in the case where a rigorous safety review has already been undertaken by a competent regulatory authority in another country.

Site Permit

The purpose of the Site Permit is to establish the conceptual design of the facility and to determine whether it is feasible to design, construct, and operate the facility on the candidate site in accordance with the safety objectives and requirements established by BAPETEN. The primary documentation required is a Site Evaluation Report providing information on:

- Specification of conceptual design of the reactor, its installation, and its planned operation;
- Current and future population density and characteristics of the surroundings of the candidate site;
- Physical conditions of the site, including seismological, meteorological, geological, hydrological and radiological aspects;
- Steps to be taken to maintain the security of environmental conditions (ecological, meteorological and cultural values) and natural reserves, airports, industries, and other places and building; and
- Analysis of potential radiation levels under a hypothetical accident situations.

The other important document required is an Environmental Impact Analysis Report, which consists of:

- Terms of Reference for Environmental Impact Analysis;
- Environmental Impact Analysis;
- Plan for Environmental Management; and
- Plan for Environmental Monitoring.

The Environmental Impact Analysis consists of:

- Design description of the complete nuclear reactor, safety systems, containment system, and waste management system; and
- Estimation of the impact on the environment during reactor construction, operation, decommissioning, and a possible nuclear accident through air, water and soil, as well as biological and socioeconomic impacts to the public within the area surrounding the reactor.

The Site Permit will be issued provided the application meets the provisions and other requirements set by BAPETEN. The Site Permit is valid for a period of 4 years, and could be extended for up to 2 x 1 year.

Construction Permit

A Construction Permit is next required but, prior to its granting, BAPETEN must be assured that the reactor design meets the safety principles and requirements set out by BAPETEN and that the plant will be built to appropriate quality standards. The primary documents required are a Preliminary Safety Analysis Report, a Probabilistic Safety Assessment, and the construction schedule. One criterion is that the NPP is already of proven technology, *e.g.* similar plant already in operation elsewhere.

The Construction Permit is given for a period up to eight years, after all requirements, including design alterations and all modifications intended to minimize negative impacts, have been fulfilled. The Permit is granted provided that any subsequent modification to the design, structures, systems or components which impact on its safety can be performed only after further consent has been obtained from BAPETEN.

In case the construction is not started within a period of 18 months after the issuance of the Construction Permit, then the Licensee should notify BAPETEN and present the reasons for the delay. If the reasons are not acceptable, the Permit can be revoked by BAPETEN.

If the Licensee considers that the construction will not be completed within the defined period, an application for an extension of the Construction Permit should be submitted at least three months before it expires, presenting the underlying reasons. Extension of the Construction Permit can be given each time for a one year period.

Operating License

When the construction approaches its completion, and at the latest before fuel loading, the Licensee should submit an application for an Operating License. BAPETEN, before issuing, has to be assured that the plant, as built, conforms to the design previously submitted and approved, and that the plans for operation are satisfactory.

The Operating License requirements include submission of a Final Safety Analysis Report, completion of a previously approved commissioning programme, examination and authorization of personnel, approval of operating policies and principles, preparation of plans and procedures for dealing with nuclear emergencies, and specific programmes for quality assurance during operation and maintenance of the reactor.

The Operating License is issued in two stages:

- A Provisional Operating License is issued for a maximum period of 24 months, including pre-operational and preliminary operational stages; and
- If, and only if, the provisional operation stage runs well and all requirements including implementation of the environmental management and monitoring plans are fulfilled, then a Long-Term Operating License could be issued and for a maximum period of forty years. Otherwise, the Provisional Operating License will be extended for a period as specified by BAPETEN based on the evaluation from the latest operation.

Among the terms included in the Operating License is the requirement that the Licensee informs BAPETEN promptly of any occurrence or situation which could affect the safety of the plant. BAPETEN retains the right to impose additional requirements at any time.

Safe operation of the plant is the responsibility of the Licensee. BAPETEN inspectors undertake periodic inspection and audits, annual reviews of operation, and major reviews at the time of renewal of the Operating License.

The Operating License may be revoked by BAPETEN for one or more of the following:

- There is evidence that false information has been submitted to BAPETEN in the application or report concerning the reactor and its operation;
- The Licensee does not comply with the specifications and/or the requirements approved by BAPETEN; and
- The Licensee does not comply with the provisions mentioned in existing regulations.

Decommissioning Permit

If the Licensee does not wish to renew the Operating License, it is required to submit an application for decommissioning to BAPETEN. The application for the Decommissioning Permit should include decommissioning plans and procedures in accordance with provisions set by BAPETEN. During and after decommissioning, BAPETEN carries out the inspection to check whether the job has been done satisfactorily and safely, and the installation holds no more hazards to the public and the environment.

Review and assessment of the licensing process

Currently, BAPETEN is establishing procedures for the review and assessment of documents provided during the licensing process. However, being a relatively young organisation, BAPETEN does not have the institutional capacity nor the technical support from institutions or consultants to enable the adequate technical review that is required for every step of the licensing process. An issue for BAPETEN is that it currently largely relies on the results presented by the applicants in the licensing documents.

Human resource development

Manpower development, availability, and expertise are key issues for BAPETEN and for the GOI, particularly looking forward to the licensing and regulation of the construction and operation of NPP. As mentioned, BAPETEN has been creating the regulatory framework for NPP licensing using the IAEA Nuclear Safety Standards as a basis and adapting them to local conditions using the experience gained in other countries with similar seismic conditions, most notably Japan. International contacts have been created to improve the competence of BAPETEN personnel, and a number of experts have been sent abroad for long-term training. Also, foreign experts have been invited to assist in building the regulatory framework, which is to be finalised and operational by 2008 when the first license application for an NPP is expected to be filed.

FUNDING OF NPP NUCLEAR WASTE MANAGEMENT AND FUTURE NPP DECOMMISSIONING

Particular to NPP compared to other electricity generation technologies is the high proportion of life-cycle costs that occur after the closure of a NPP. Decommissioning and waste management costs represent around 10-15% of total investment costs. The special nature of radioactive waste demands correct management until final disposal. Especially in the case of high-level radioactive waste (such as spent reactor fuel), surveillance is required for tens or even hundreds of years after the waste disposal facility has been closed.

A priority aspect to ensure safe decommissioning and waste disposal is to have financial resources available at the moment they are needed. Currently the most often used method is to collect the funds during the operational phase of the NPP. The method for preserving these funds for their correct use varies between countries.

BATAN is responsible for current nuclear waste management in Indonesia, as well as waste developed from any future NPPs. Currently, waste generated in Indonesia's nuclear installations (primarily research reactors), research activities, and medical applications is stored in interim storage and is generally low-level waste. Only tentative plans exist for final disposal of these wastes.

A key issue for the GOI and, possibly, BAPETEN will be to determine its mechanism for the funding of NPP high-level nuclear waste and anticipated decommissioning costs. BATAN must be able to ensure NPP waste management/storage planning and implementation is put in place in concert with the NPP programme.

Conclusions and recommendations

Indonesia has undertaken the early building of a national nuclear R&D and regulatory capacity, and discussions highlighted Indonesia's working in concert with the UN International Atomic Energy Agency on institutional and procedural matters. However,

financial and technical assessment and the capacity of Indonesia industry to support the introduction of NPP are beyond the ambit of this review. From an energy policy viewpoint, the following recommendations are targeted for the GOI's action if the introduction of NPP is determined.

The IEA Review Team recommends that the Government of Indonesia:

- Ensure that the nuclear power tariff reflects the full long-term cost of nuclear power generation, including nuclear waste management and nuclear power plant decommissioning.
- Ensure that the legal framework for financing and ownership of NPP is in place in a timely manner and include NPP investment as part of the general efforts of the GOI to attract foreign investment.
- Recognising national and regional concerns over the introduction of NPP into Indonesia, strengthen and co-ordinate the current efforts of BAPETEN and BATAN to keep the Indonesian community and Indonesia's regional neighbours informed.
- Strengthen international collaboration to enhance the capacity of BATAN to be expertly involved in each stage of NPP construction and operation. Such collaboration should focus on those countries having either on-going or recent experience in construction and operation of nuclear power plants.
- Ensure that nuclear waste management by BATAN or some other organisation, including decommissioning, is properly funded and that the planning and implementation of waste management is advanced in parallel with the construction and operation of the nuclear power plant.
- Ensure that BAPETEN has independent decision-making autonomy so that its decisions cannot be overruled.
- Strengthen international collaboration to enhance the capacity of BAPETEN to implement the required NPP licensing and regulatory framework. Such collaboration should focus on those countries having either on-going or recent experience in licensing nuclear power plants.

XIII. ENERGY RESEARCH, DEVELOPMENT AND TRAINING

BEST PRACTICE IN ENERGY R&D AND TRAINING

Energy research and development (R&D) refers to the stages of R&D from innovation through to implementation, namely basic research, application-orientated R&D, pilot and demonstration testing, and technology deployment/market uptake. However, for developing economies with limited institutional facilities, human capacities, public sector funding, or an engaged private sector, the R&D spectrum will understandably be something less.

Each country must choose energy R&D policies that will enable it to most effectively meet its national energy priorities, and there are several key descriptors that can be used to guide a review of a national energy R&D policy, including:

- Energy R&D institutions and stakeholders;
- National energy R&D strategy;
- Evaluation procedures for energy R&D programmes;
- Energy R&D funding;
- Energy R&D outreach;
- Role of the private sector in energy R&D;
- Training and human capacities role in energy R&D;
- Energy R&D links with basic science research; and
- International R&D collaboration and how this is prioritized.

These will be discussed in this review of Indonesia's energy research and development and training.

Through many years of reviewing energy policy and programmes and from the recommendations of the IEA Expert Group on Research and Development Priority Setting and Evaluation, the following elements have been found to contribute to a country's effective energy R&D and training:

- a clear definition of government's role in energy technology development;
- a national energy strategy (policy directions and goals);
- an accompanying R&D strategy (goals, technologies, R&D priorities);
- adequate and stable funding for R&D;
- well defined and transparent R&D prioritization processes;
- well defined and transparent R&D evaluation methods;
- linkage with innovation policies for market uptake;
- linkage with basic science;
- linkage with national research and innovation strategy;

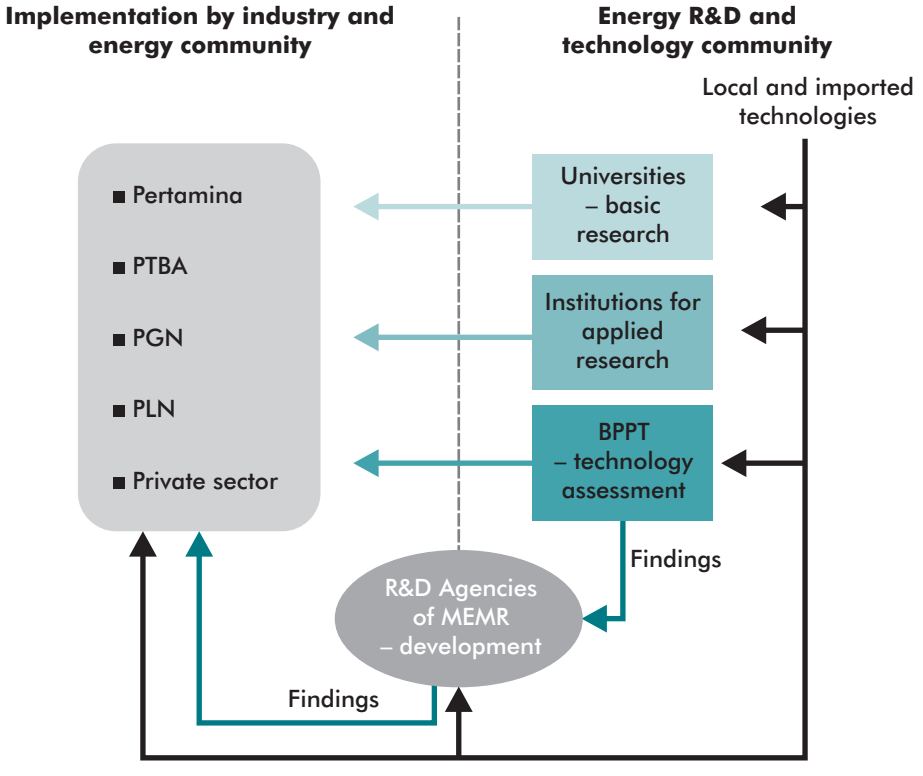
- involvement of R&D stakeholders in priority setting and evaluation;
- public-private R&D partnerships; and
- linkage with international collaboration on R&D.

INSTITUTIONS STRUCTURE, ROLES AND RESPONSIBILITIES

The Government of Indonesia (GOI) has a number of capable, qualified institutions that are conducting valuable energy R&D and energy sector training. In their discussions with the Review Team, most of the institutions felt that they were well funded, have input to national energy policy, and co-ordinate actively amongst themselves and with the private sector and bilateral donors. However, based on the experience of some IEA member countries, there is a need to reconsider some of these areas.

Chapter VIII, Articles 29 and 30 of the new Energy Law No. 30/2007 stipulate that the GOI facilitate R&D for new and renewable energy technologies. The State Ministry of Research and Technology co-ordinates formulation of this policy among various stakeholders through the National Research Council.

Figure 13.1 ..... Energy research and development institutions and relationships in Indonesia



Source: Ministry of Energy and Mineral Resources.

Under the Ministry for Research and Technology, the Agency for Assessment and Application of Technology (BPPT) is the leading energy R&D organisation and it focuses on near-commercial demonstration and application of energy technologies. The Indonesian Institute of Sciences (LIPI), also under the Ministry's co-ordination, focuses primarily on renewable energy technology R&D.

The Ministry of Energy and Mineral Resources (MEMR) has several entities active in energy R&D and its activities are managed by its Agency for Research and Development and its Agency of Geology. Other energy R&D players in Indonesia include BATAN, a presidential-level independent agency which manages nuclear energy research and human capacity efforts (covered in more detail in the Nuclear chapter), and the Ministries of Forestry and Agriculture, which undertake biofuels research and demonstration through pilot projects.

State Ministry for Research and Technology and the Agency for Assessment and Application of Technology (BPPT)

The State Ministry of Research and Technology is responsible for formulating national policies in the field of research, science and technology, and implementing its co-ordination across Indonesia stakeholders. There are four non-departmental research agencies under the State 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), discussed in the Nuclear chapter; and
- National Atomic Energy Agency (BATAN), discussed in the Nuclear chapter.

The Agency for Assessment and Application of Technology (BPPT) is the lead applied energy R&D institution in Indonesia and reports directly to the President of Indonesia. BPPT performs technology assessments and demonstrations, undertakes energy modelling and analysis to inform national policy makers, and works with the private sector and other GOI agencies to transfer technologies to the marketplace. The BPPT technology focus conforms to National Energy Policy, and includes research on a variety of biofuel feedstocks, coal gasification/liquefaction, small-scale geothermal plants (2.5 MW and lower), fuel cells, and, to a lesser extent, solar, ocean and wind energy. In addition to energy R&D and demonstration for the GOI, BPPT offers its services to the private sector on a fee-for-service basis.

Projects are funded on a 3-5 year basis and are given goals such as information input into 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.

BPPT has strong capabilities in energy technology modelling and forecasting, including a long and experienced application of the least cost optimisation model, MARKAL.

It appears to be the only GOI institution in Indonesia with the mandate and capacity to undertake long-term energy sector planning. This planning is extremely valuable in providing insights to policy makers on the costs, benefits, and expected performance of various technology options. Indonesia should work to strengthen this analytical capability.

The Indonesian Institute of Sciences (LIPI) is a non-departmental research institution directly responsible to the President of Indonesia. It conducts strategic and fundamental research in science and technology with a focus on sustainable development. Hence, the LIPI energy focus is on new and renewable energy technologies:

- Biodiesel as a component of alternative clean fuels that extend engine life;
- Micro-hydro (propeller turbine type and cross-flow turbines) for generating electricity in remote villages; and
- Fuel cell based on hydrogen to generate electricity with high efficiency.

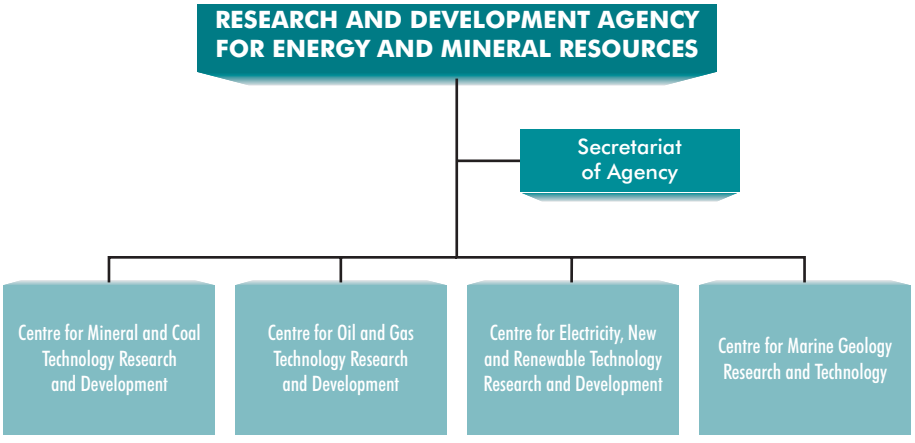
Agency for Research and Development, MEMR

Within MEMR, the Agency for Research and Development co-ordinates four specialised R&D centres, namely

- tekMira (R&D Centre for Mineral and Coal Technologies);
- Lemigas (R&D Centre for Oil and Gas Technology);
- P3TKEBT (R&D Centre for Energy and Electricity Technology, including new and renewable electricity technologies and energy efficiency); and
- PPPGL (the Marine Geology Institute).

Programme review is undertaken by the Secretariat of the Agency for R&D.

Figure 13.2 ..... Organisation of the Agency for Energy Research and Development, MEMR



Source: Ministry of Energy and Mineral Resources.

Research and Development Centre for Mineral and Coal Technology

Coal is anticipated to be the main source of energy in Indonesia by the year 2025, and the Research and Development Centre for Mineral and Coal Technology (tekMira) implements a research programme designed to expand the use of lower-rank coals and to reduce the environmental impacts of coal use. Low-rank coal R&D focuses on direct use for electricity and heat, upgrading the coal's quality for export markets and conversion through liquefaction or gasification.

Indonesia has a strong bilateral partnership with Japan to study liquefaction of different types of Indonesian brown coal; it expects to have a semi-commercial 13 500 bbl/day demonstration plant operational in 2013. Coal gasification efforts include prototypes for a variety of industry settings, including agricultural commodities drying, in diesel engines, and in the chemical industry. Clean coal R&D includes liquefaction and gasification, as well as enhanced pre- and post-combustion technologies like low-NOx burners, fluidized bed combustion, and integrated gasified combined cycle (IGCC).

In addition to its coal R&D, tekMira has a smaller mineral R&D programme involving developing new cement feedstocks and processing and utilisation of new industrial minerals.

Research and Development Centre for Oil and Gas Technology

The Research and Development Centre for Oil and Gas Technology (Lemigas) was founded in 1965 to conduct applied R&D in upstream and downstream oil and gas. Lemigas formulates overall work procedure and guidelines, including a performance-based evaluation of R&D, administers partnerships with the private sector and manages intellectual property rights. Lemigas also provides research and technology services to private sector oil and gas companies for a fee. These services include laboratory analysis, technical consultation, feasibility assessment, equipment leasing and use of Lemigas experts.

The Lemigas portfolio includes five key areas of activity. In each of these five areas, Lemigas undertakes R&D, and provides scientific documentation, services in laboratory studies, and expert technical advice on:

- Exploration technology: survey and mapping, exploration development, inventories of resource potential;
- Exploitation technology: enhanced hydrocarbon recovery R&D to increase the status of proven oil and gas reserves;
- Process technology: technology development, design engineering, environment mitigation technology development, and biotechnology development for biofuels and corrosion resistance;
- Product application technology: focusing on downstream oil fuels and lubricants; and
- Natural gas technology: gas hydrates development, corrosion resistance, natural gas quality enhancement, gas-to-liquids, and compressed natural gas for transportation.

Lemigas also conducts R&D into reducing environmental impacts of oil and gas activities, and on improving energy efficiency through reduced hydrocarbon leaks and losses.

Research and Development Centre for Electricity and Renewable Energy Technology

The Research and Development Centre for Electricity and Renewable Energy Technology (P3TKEBT) is the lead MEMR R&D centre on technologies for power generation and transmission/distribution networks, renewable energy technologies for electricity generation (micro-hydro, geothermal, biomass, solar, wind and ocean energy), and energy efficiency. P3TKEBT has a smaller R&D presence in renewable fuels, including biofuels, direct use of geothermal and methane from municipal solid waste.

P3TKEBT's R&D portfolio of energy efficiency activity is quite small, with the main focus on reducing electricity consumption of commercial lighting. There are many opportunities for additional R&D across the suite of industrial, commercial, residential and transportation efficiency technologies and practices.

Marine Geology Institute

The Marine Geology Institute (PPPGL) conducts marine geology R&D in areas such as geological mapping, offshore energy and mineral resources identification, and marine geophysics. Notable research achievements include the establishment of a systematic marine geological map, including the continental shelf beyond 200 nautical miles, a hydrothermal mineral survey, and a coastal and offshore geo-technique assessment.

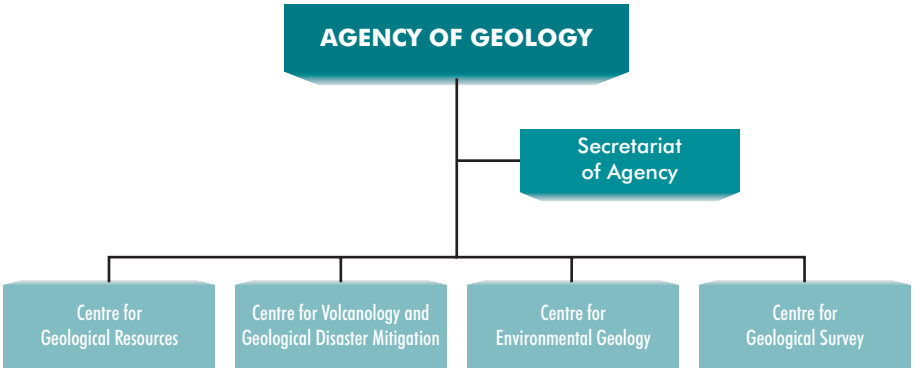
Agency of Geology, MEMR

The Agency of Geology within MEMR has responsibility to research and assess Indonesia's geological resources and to promote its sound management. The Agency co-ordinates four specialised centres, namely

- the Centre for Geological Resources;
- the Centre for Volcanology and geological disaster mitigation;
- the Centre for Environmental Geology; and
- the Centre for Geological Survey.

Programme review is undertaken by the Secretariat of the Agency of Geology.

Figure 13.3 ..... Organisation of the Agency of Geology, MEMR



Source: Ministry of Energy and Mineral Resources.

Centre for Geological Resources

The Centre for Geological Resources is in charge of carrying out research in the field of geological resources, including the assessment of oil and gas resources, and minerals and coal.

Centre for Volcanology and Geological Disaster Mitigation

The aim of the Centre for Volcanology and Geological Disaster Mitigation is to conduct research, investigation and services in the field of volcanology and geological hazards mitigation. Several databases relating to earthquakes, landslide and tsunami are available to the public online.

Centre for Environmental Geology

The Centre for Environmental Geology is set to perform research, surveys and services in the field of environmental geology and ground water. The Centre deals with environmental geology, engineering geology, groundwater and spatial data management.

Centre for Geological Survey

The Centre for Geological Survey is in charge of conducting surveys, research, investigation and services in geological field. Research includes the study of magmatism, of basin geodynamic, quaternary geodynamic and mapping.

Ministries of Agriculture and of Forestry

The main energy R&D activities for the Ministries of Agriculture and of Forestry are in relation to biofuels research and demonstration through pilot projects. The Ministry of Agriculture is primarily concerned with the "upstream" side of plantation planning and development. The Ministry of Forestry is undertaking R&D into biofuels feedstocks, including jatropha and palm oil, to asses which species are most economic and to identify species with the greatest greenhouse gas (GHG) emissions reduction potential. The Ministry supports biofuels demonstration projects by providing land for demonstration projects. There was no additional information available on the scope of and funding for the biofuels R&D efforts.

CO-ORDINATION

Co-ordination of activities across R&D institutions plays a crucial role in a cost-effective R&D programme by assisting the incremental building of results and avoiding activity duplication. Being able to demonstrate effective co-ordination is generally necessary for accessing limited public funds.

In Indonesia, there is the need for greater co-ordination among the various institutions in energy R&D. Many agencies and R&D institutions reported that they are in regular communication with their counterparts in other institutions, but that there was no formal mechanism for energy R&D co-ordination and decision making. The National Research Council in the Ministry for Research and Technology holds annual meetings of energy R&D organisations in an effort to co-ordinate programme activities and plans.

Within MEMR, the Secretary of the Agency for Research and Development plays a co-ordinating role. However, despite efforts, it is unclear how much co-ordination actually occurs before and after programmes are implemented, as there are several projects with a similar focus, particularly in the biofuels area. The National Team for Biofuels has responsibility for co-ordinating biofuels research among at least four ministries, and there appears to be significant overlap of several projects and duplication of R&D efforts.

LINKING ENERGY RESEARCH AND DEVELOPMENT TO NATIONAL POLICY GOALS

A clear national energy policy is the starting point to formulating an outcome-orientated public sector energy R&D policy. Indonesia's energy R&D priorities were presented as reflections of National Energy Policy/National Energy Management Blueprint goals, which aim to:

- significantly increase flare gas utilisation and oil and gas production;
- survey new and renewable energy potential; develop and utilise alternative transportation fuels, including CNG, GTL and others;
- develop and commercialise clean coal and upgraded coal technologies; and
- develop and commercialise renewable and alternative energy technologies, including biofuels, coal bed methane, natural gas hydrates, and others.

There appears to be a wealth of energy R&D underway that can support these energy policy goals. However, there has not been a national energy R&D roadmap or similar process to establish a clear link between national energy policy and energy R&D and other relevant policy areas (*e.g.* innovation, education and industrial policies), or to assess the priorities among competing R&D options and their resourcing and funding.

Many of the R&D experts were sceptical about Indonesia's ability to meet the above ambitious goals, given their current R&D results. There are also some lower-priority R&D projects that continue to receive funding (*e.g.*, fuel cell research), while other areas such as clean coal and energy efficiency may not be receiving sufficient support. Energy efficiency R&D receives a very small budget (Rp 2 billion in 2007), which undermines Indonesia's ability to benefit from this cost-effective clean energy option.

EVALUATING RESEARCH AND DEVELOPMENT PROGRESS

Effective monitoring and evaluation of public sector funded energy R&D is crucial to maximising the effectiveness of R&D programmes. New programmes must be justified, demonstrating consistency with national priorities and likelihood of success. Existing programmes must be re-evaluated, modified, redirected or terminated, in keeping with national priorities.

Methods for evaluation are diverse and include self-evaluation by programme managers or programme owners as well as evaluations by external experts. Most evaluations use statistical data and interviews with stakeholders to get a comprehensive view and to develop recommendations.

The MEMR Agency for Research and Development evaluates planned research activities via a Standard Operating Procedure that requires the responsible R&D centre to fill out a form at the beginning of a project with terms of reference, including the project budget and milestones. The MEMR Secretariat then measures projects against these criteria upon completion. Evaluations are also performed on an annual basis to assess progress towards programme goals, and a report is prepared for the MEMR and other government entities.

Within the Ministry of Research and Technology, BPPT projects are assessed regularly. However, there is very little use of non-government or independent experts to review and assess projects and/or larger programme goals.

RESEARCH AND DEVELOPMENT FUNDING

IEA member countries' experiences point to the sustained and transparent funding of energy R&D as being critical to the development of energy technologies to solve mid- and long-term challenges. R&D funding data is essential for designing cost-effective R&D policy.

Public funding for energy R&D in Indonesia appears to be robust and growing. According to MEMR discussions, its 2007 budget for energy R&D is approximately Rp 400 billion. Funding data was not available for energy R&D conducted by other ministries, including the Ministry of Research and Technology (which funds BPPT) and the Ministry of Forestry.

The estimated 2007 budget for the R&D centres within the MEMR is given below.

Table 13.1 ..... Funding for MEMR R&D centres, 2007 (billion rupiah)

Centre	National government funding	Private sector funding
tekMira	110	2.6
Lemigas	362	26.3
P3TKEBT	44	0.017
Marine Geologic Institute	95	0.031
Agency of Geology	433	0.108

Source: Ministry of Energy and Mineral Resources.

These figures appear to be much higher than that shown by recent public data, evidencing growth in Indonesian funding for public sector energy R&D. For example,

Lemigas' annual report for 2004 put the centre's budget at just under Rp 146 billion. In 2005, this figure has grown to almost Rp 184 billion.

Indonesia's private sector sponsors energy R&D mainly on a fee-for-service basis, and does not engage in longer-term non-commercial R&D. Consequently, it is increasingly important to involve the private sector in planning national R&D to ensure appropriate technology development and uptake. Bilateral donors, particularly Japan in the area of clean coal, are also significant funding sources. However, there is no public data available to confirm the amount of private sector and foreign aid monies that are spent on energy R&D in Indonesia.

OUTREACH

Outreach to the community and the market place by energy R&D institutions in Indonesia is intended to strengthen public awareness of energy R&D targets and their progress. The results of programmes are publicly disseminated by the MEMR through an annual event called the "R&D Forum on Energy and Mineral Resources", which is attended by stakeholders in government, industry, academic institutions, and NGOs.

MEMR also publishes results of its energy R&D in a Mineral and Energy Journal, published four times a year. Each of the R&D centres in the MEMR also has its own public journal for dissemination of activities and results and a public website that supplements the annual meeting and journals.

These outreach activities are an excellent basis, and would usefully be expanded in two ways: namely, the websites should be translated into English to encourage a broader audience among potential private sector and international R&D partners, and more information could be provided on budgets, priorities, and evaluations of R&D projects.

THE ROLE OF THE PRIVATE SECTOR

Very little information is publicly available on private sector energy R&D funding, and only in the most visionary cases does the private sector energy R&D look beyond a short-term horizon. Private sector R&D typically focuses on accelerating R&D stages involving technology development, demonstration, and market uptake by industry. Government collaboration generally has the effect of shifting some government funding away from longer-term R&D.

In Indonesia, the private sector plays a similarly limited role in energy R&D. Multinational energy companies operating in the oil and gas and geothermal sectors have accomplished some technology and know-how transfer. Other companies in the oil and gas sector fund feasibility studies, training, and other pre-commercial activities.

Apart from this, private companies, including state-owned enterprises, appear to do little independent R&D and do not engage in longer-term non-commercial R&D. Instead, they pay governmental organisations a service fee for specialised research. This limited private sector role reduces opportunities for innovation and market uptake, and places the responsibility for energy R&D almost exclusively on the public sector.

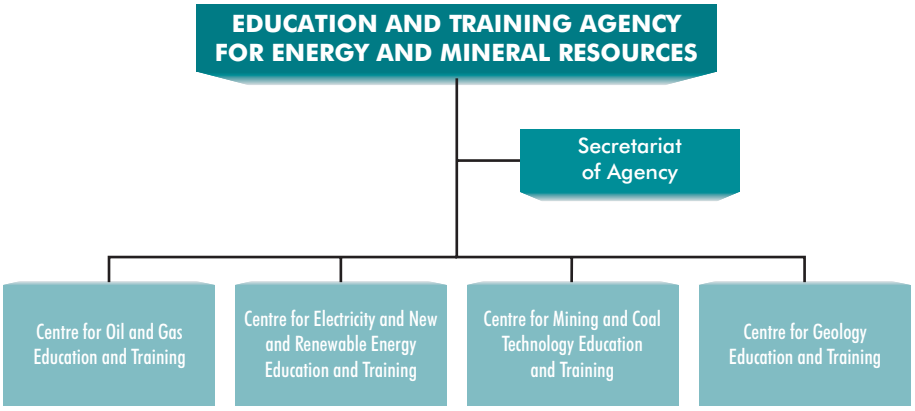
TRAINING AND HUMAN CAPACITY

Experiences of IEA countries indicate that both adequate human resources and their training and capacity development are decisive factors for the success of national policy goals. In Indonesia, the MEMR Agency for Education and Training (ETA) is the lead actor in energy training and is also responsible for co-ordinating MEMR wider capacity development.

Agency for Education and Training, MEMR

The ETA mission is to develop and implement policies on education and training in the field of energy and mineral resources, by ensuring adequate numbers of skilled personnel. This includes managerial and technical capacity-building. It accepts trainees from national and local governments dealing with the sector, but also candidates from industry and universities. Increasingly it serves to support the large training need from the regions and provinces. (Nuclear energy capacity building and training are the responsibility of BATAN, and are discussed in the Nuclear chapter.)

Figure 13.4 ..... Organisation of the Agency for Education and Training, MEMR



Source: Ministry of Energy and Mineral Resources

The ETA has four education and training centres, namely the Centres for Electricity and New and Remevable Energy, Oil and Gas, Geology, and Mining and Coal Technology. These Centres closely mirror the MEMR Directorate Generals and

the Centres of the Agency for Research and Development. The training Centres report strong relationships with their related agencies with the MEMR, especially the R&D Centres which send staff to ETA to receive training and provide input to the ETA's training programme. The ETA oil and gas centre is the largest training centre and is reported to receive the majority of funds. However, funding data were not available.

The ETA Centres offer a diverse set of capacity development and training programmes, and the ETA has a number of training facilities, laboratories, workshops, simulators and other equipment that are used to conduct specialised training and education. It possesses several training facilities with ISO accreditation and many supporting facilities, including refinery and power plant.

The government has successfully engaged the private sector to provide strategic direction, regular feedback, and funding to advance its energy training programmes.

There are two principal groups of courses:

- competency-based training to help MEMR personnel meet the goals of the National Energy Policy. This group covers intensification of coal and gas utilisation, renewable energy, energy efficiency and conservation, energy auditing, regional energy planning, and electricity (power generation, transmission and distribution); and
- personnel certification by independent bodies. This is aimed at provided a skilled work force in support of the oil and gas and electricity sectors.

The ETA also consciously trains skilled workers for work in the Middle East. Many workers prefer this option as the salaries are higher. As a consequence, retention of skilled workers in Indonesia is becoming a problem.

ETA programmes are focused primarily on traditional oil, gas, and coal technologies, and, as a result, the agency does not have sufficient funding or support to build human capacity in the clean energy technologies that are part of the National Energy Policy.

The ETA appears to have greater capacity to teach technical material than economic and policy analysis. It acknowledges that it needs to develop a comprehensive new course with this perspective and a deep coverage of analytical tools, but recognises that knowledge of this kind is relatively scarce in Indonesia: it is hard to develop materials and to find qualified staff to teach.

Decentralisation of responsibility to local governments has posed a difficult challenge to the training function, especially in the mining sector. The combination of increased coal production and the shift of responsibilities to the regions have both caused a significant increase in demand for training of staff from regional administrations. The ETA has established training facilities in the regions and has moved staff and materials. Despite this, the volume of training that they can perform is insufficient to form the numbers required. Insufficient budgets are a severe restriction and the ETA envisages asking the mining companies to contribute from their ring-fenced community fund. It is important that this exercise be supported adequately.

BASIC SCIENCE RESEARCH

Policy Reviews in IEA countries have demonstrated that advances in basic science are the foundation for progress on myriad energy technologies. Creating linkages between basic science R&D and applied technology development is crucial to creating technology breakthroughs.

There was little information about the status of basic science research for energy R&D in Indonesia. The lead institution here is the National Science Institute (LIPI), which co-ordinates energy R&D activities and priorities through the Ministry of Science and Technology. It appears that basic research is undertaken almost exclusively by academic institutions; several universities have basic science research programmes with energy centres. There appears to be co-operation between these institutions and the GOI and it would be useful for these linkages to be more explicit.

INTERNATIONAL CO-OPERATION

Multilateral and bilateral international co-operation are a means of increasing widespread benefit of energy R&D: international collaboration promises better returns on R&D investment through the sharing among participants of financial outlay, workload, and results. International collaboration can reduce the need to expend public sector funds on R&D that is underway in other countries and that is not essential for national competitiveness.

International collaboration can also make use of specialised expertise that resides in one country to the benefit of all countries involved. Further, it can strengthen technology market uptake by combining national comparative advantages, such as combining the science and technology strengths of an industrialised country with the lower labour costs for manufacturing in a developing country.

Indonesia has a number of bilateral co-operative international research efforts in clean coal, biofuels, geothermal and oil and gas exploration, and production technologies. These efforts are focused on technology R&D. Examples of international co-operation are listed below.

Table 13.2..... Examples of international energy R&D co-operation

Country	Institution	Activities	Indonesia R&D organisation
Malaysia	PETRONAS	Applied R&D in oil and gas	Lemigas
United Kingdom	Watt University	Oil and gas R&D and training	Lemigas
Korea	Institute of Geoscience and Mineral Resources	Geologic surveys for oil and gas	Lemigas
Japan	Japan International Co-operation Agency	Oil and gas R&D, energy training	Lemigas, ETA
USA	Office of Surface Mining	Energy training: coal	ETA
Japan	NEDO	Brown coal liquefaction	BPPT

Source: Ministry of Energy and Mineral Resources.

These international collaboration efforts are commendable, and will need to be expanded to include clean energy and energy efficient technologies R&D that Indonesia will have to rely upon to achieve its National Energy Policy goals. The IEA facilitates international energy R&D collaboration by providing a legal framework to over 40 energy technology and R&D co-operation agreements, known as Implementing Agreements. These Implementing Agreements bring together governments, international organisations and R&D institutions worldwide who wish to collaboratively focus on a specific energy technology R&D. The Implementing Agreements are open to both IEA member countries and non-IEA countries.

Conclusions and recommendations

As a developing economy with immediate energy policy priorities and with the opportunity to work collaboratively with international R&D institutions, Indonesia will likely be a technology taker for the next several years. However, Indonesia also has an enviable resource base, particularly in bioenergy, geothermal, and distributed solar, and it has the institutional capacity to build from its current R&D efforts to being a contributor to global research in these areas in the future.

Recent discussions with the MEMR Agency for R&D pointed to the awareness within Indonesia's R&D community of the need for improved co-ordination and roadmapping of the national energy R&D effort. The State Ministry of Research and Technology is believed to currently be preparing a "Blueprint on Readiness of Research and Development in Energy".

The IEA Review Team recommends that the Government of Indonesia:

- Assess whether existing R&D co-ordinating structures are in fact delivering real co-ordination, by identifying and eliminating overlaps in research areas among the various institutions. A formal plan for national energy R&D co-ordination should be established, with clear roles and responsibilities, regularly scheduled meetings of experts to co-ordinate activities, and transparency for industry and the public.
- Undertake a national energy R&D roadmapping to assess the status of research in key technology areas so as to better match R&D efforts with the goals of the National Energy Policy. The roadmap should include:
  - Identifying the key technology and R&D areas with the highest potential for meeting the goals of the National Energy Policy;
  - Identifying roles and responsibilities of key actors across the GOI;
  - Working with the private sector, universities, and other R&D stakeholders to develop and implement a transparent process by which R&D projects and programmes can be evaluated, including criteria such as private-sector technology investments, technology competitiveness, environmental impacts, and national human capabilities; and
  - Compiling a clear set of national energy R&D and training funding data, including universities and the private sector where possible, to allow for improved assessment of cost-effectiveness of activities.

- Provide additional support to the MEMR R&D centres and to the Agency for Education and Training, so as to enable these institutions to make the transition from traditional fossil resources to clean energy technologies, including energy efficiency.
- Enhance international outreach and public engagement with Indonesia's energy R&D efforts, by providing websites and journals in English, and holding public meetings to communicate results and receive critique.
- Encourage greater private sector involvement in state-owned enterprises energy R&D expenditure, through cost and benefit sharing partnerships particularly in R&D focussing on technology development, demonstration, and market uptake.
- Provide sufficient resources and "training of the trainers" to ETA training centres so they can provide training in biofuels, energy efficiency, clean coal, and other energy priorities.
- Pursue enhanced international collaboration opportunities that do not involve donor funding, to benefit from objective, unbiased information about technology developments. IEA Implementing Agreements are one such collaboration network.

INDONESIA ENERGY BALANCE 2006*

Unit = thousand barrels oil equivalent.

	Hydro power	Geother-mal	Biomass	Coal	Natural gas	Crude oil	Fuel	LPG	Other pe-troleum products	Electricity	LNG	Total
1. Primary energy supply	**24 257**	**11 183**	**276 329**	**209 325**	**501 523**	**339 799**	**130 162**	**-1 493**	**-37 193**	**0**	**-211 261**	**1 242 630**
a. Production	24 257	11 183	276 329	813 798	530 538	367 049		0	0	0	0	2 023 153
b. Import	0	0		473	0	116 232	134 635	588	0	0	0	251 928
c. Export	0	0		-603 258	-29 015	-134 960	-281	-2 470	-37 193	0	-211 261	-1 018 439
d. Stocks**	0	0		-1 687	0	-8 522	-4 193	388	0	0	0	-14 014
2. Energy transformation	**-24 257**	**-11 183**	**-58**	**-118 871**	**-300 216**	**-333 136**	**187 483**	**10 907**	**70 669**	**81 595**	**208 676**	**-228 391**
a. Refinery	0	0	0	0	-2 723	-333 136	254 190	3 258	70 669	0	0	-7 743
b. LPG plant	0	0	0	0	-5 905	0	0	7 649	0	0	0	1 744
c. LNG plant	0	0	0	0	-257 922	0	0	0	0	0	208 676	-49 246
d. Coal processing plant	0	0	0	-203	0	0	0	0	0	0	0	-203
e. Power plant	-24 257	-11 183	-58	-118 668	-33 667	0	-66 707	0	0	81 595	0	-172 944
- State-owned utility (PLN)	-22 079	-5 389	0	-80 155	-28 358	0	-65 996	0	0	64 039	0	-137 937
- Independent power producer	-2 178	-5 794	-58	-38 513	-5 309	0	-711	0	0	17 556	0	-35 007
3. Own use and losses	**0**	**0**	**0**	**0**	**-80 529**	**-6 663**	**-620**	**0**	**0**	**-8 789**	**0**	**-96 600**
a. During transformation process	0	0	0	0	-57 948	0	-14	0	0	0	0	-57 962
b. Gas flaring	0	0	0	0	-20 212	0	0	0	0	0	0	-20 212
c. Transmission & distribution	0	0	0	0	-2 369	-6 663	-605	0	0	-8 789	0	-18 426
4. Final energy supply	**0**	**0**	**276 271**	**90 454**	**120 777**	**0**	**317 025**	**9 414**	**33 476**	**72 807**	**-2 585**	**917 638**
5. Statistical discrepancy	**0**	**0**	**0**	**0**	**18 950**	**0**	**0**	**0**	**0**	**3 861**	**-2 585**	**20 226**
6. Final energy consumption	**0**	**0**	**276 271**	**90 454**	**101 828**	**0**	**317 025**	**9 414**	**33 476**	**68 945**	**0**	**897 412**
a. Industry	0	0	46 676	89 043	84 407	0	58 065	1 453	0	28 335	0	307 980
b. Transportation	0	0	0	0	42	0	173 512	0	0	41	0	173 595
c. Household	0	0	228 186	151	128	0	50 862	6 719	0	26 821	0	312 867
d. Commercial	0	0	1 409	0	206	0	7 990	1 241	0	13 748	0	24 594
e. Other sector	0	0	0	0	0	0	26 595	0	0	0	0	26 595
7. Non-energy use	**0**	**0**	**0**	**1 260**	**17 046**	**0**	**0**	**0**	**33 476**	**0**	**0**	**82 629**

* Preliminary data. ** Stocks value is calculated.
Source: Ministry of Energy and Mineral Resources.

INDONESIA ENERGY BALANCE 2007*

Unit = thousand barrels oil equivalent.

	Hydro Power	Geother-mal	Biomass	Coal	Natural gas	Crude oil	Fuel	LPG	Other pe-troleum products	Electricity	LNG	Total
1. Primary energy supply	**28 451**	**11 422**	**274 435**	**271 339**	**463 252**	**339 799**	**152 787**	**-1 090**	**-16 302**	**0**	**-233 543**	**1 290 551**
a. Production	28 451	11 422	274 435	911 333	503 875	347 493		0	0	0	0	2 077 009
b. Import	0	0		466	0	110 449	129 914	588	0	0	0	241 416
c. Export	0	0		-672 864	-40 623	-127 135	0	-2 470	-16 302	0	-233 543	-1 092 936
d. Stocks**	0	0		32 404	0	8 992	22 874	791	0	0	0	65 061
2. Energy transformation	**-28 451**	**-11 422**	**-66**	**-152 908**	**-280 708**	**-333 136**	**164 475**	**12 015**	**79 506**	**81 595**	**225 757**	**-243 343**
a. Refinery	0	0	0	0	-4 485	-333 136	235 856	7 354	79 506	0	0	-14 906
b. LPG plant	0	0	0	0	-6 303	0	0	4 661	0	0	0	-1 642
c. LNG plant	0	0	0	0	-233 542	0	0	0	0	0	225 757	-7 785
d. Coal processing plant	0	0	0	-266	0	0	0	0	0	0	0	-266
e. Power plant	-28 451	-11 422	-66	-152 643	-36 377	0	-71 381	0	0	81 595	0	-218 744
- State -owned utility (PLN)	-26 790	-5 686	0	-90 159	-30 749	0	-70 670	0	0	64 039	0	-160 014
- Independent power producer	-1 662	-5 497	-66	-62 484	-5 628	0	-711	0	0	17 556	0	-58 491
3. Own use and losses	**0**	**0**	**0**	**0**	**-71 051**	**-6 663**	**-621**	**0**	**0**	**-8 789**	**0**	**-87 123**
a. During transformation process	0	0	0	0	-51 052	0	-14	0	0	0	0	-51 066
b. Gas flaring	0	0	0	0	-17 585	0	0	0	0	0	0	-17 585
c. Transmission & distribution	0	0	0	0	-2 413	-6 663	-607	0	0	-8 789	0	-18 472
4. Final energy supply	**0**	**0**	**274 369**	**118 430**	**111 494**	**0**	**316 641**	**10 925**	**63 204**	**72 807**	**-7 785**	**960 084**
5. Statistical discrepancy	**0**	**0**	**0**	**0**	**9 424**	**0**	**0**	**0**	**0**	**627**	**-7 785**	**2 266**
6. Final energy consumption	**0**	**0**	**274 369**	**118 430**	**102 069**	**0**	**316 641**	**10 925**	**63 204**	**72 180**	**0**	**957 818**
a. Industry	0	0	42 108	116 582	83 839	0	54 182	1 242	0	28 077	0	326 030
b. Transportation	0	0	0	0	49	0	178 216	0	0	0	0	178 265
c. Household	0	0	230 860	198	132	0	50 226	8 345	0	29 010	0	318 772
d. Commercial	0	0	1 402	0	274	0	7 924	1 337	0	15 092	0	26 029
e. Other sector	0	0	0	0	0	0	26 094	0	0	0	0	26 094
7. Non-energy use	**0**	**0**	**0**	**1 650**	**17 776**	**0**	**0**	**0**	**63 204**	**0**	**0**	**82 629**

* Preliminary data. ** Stocks value is calculated.
Source: Ministry of Energy and Mineral Resources.

ANNEX II

INTERNATIONAL ENERGY AGENCY "SHARED GOALS"

The member countries of the International Energy Agency (IEA) seek to create conditions in which the energy sectors of their economies can make the fullest possible contribution to sustainable economic development and to the well-being of their people and of the environment. In formulating energy policies, the establishment of free and open markets is a fundamental point of departure, though energy security and environmental protection need to be given particular emphasis by governments. IEA countries recognise the significance of increasing global interdependence in energy. They therefore seek to promote the effective operation of international energy markets and encourage dialogue with all participants.

In order to secure their objectives, member countries therefore aim to create a policy framework consistent with the following goals:

Diversity, efficiency and flexibility within the energy sector are basic conditions for longer-term energy security: the fuels used within and across sectors and the sources of those fuels should be as diverse as practicable. Non-fossil fuels, particularly nuclear and hydro power, make a substantial contribution to the energy supply diversity of IEA countries as a group.

Energy systems should have **the ability to respond promptly and flexibly to energy emergencies**. In some cases this requires collective mechanisms and action: IEA countries co-operate through the Agency in responding jointly to oil supply emergencies.

The environmentally sustainable provision and use of energy are central to the achievement of these shared goals. Decision-makers should seek to minimise the adverse environmental impacts of energy activities, just as environmental decisions should take account of the energy consequences. Government interventions should respect the Polluter Pays Principle where practicable.

More environmentally acceptable energy sources need to be encouraged and developed. Clean and efficient use of fossil fuels is essential. The development of economic non-fossil sources is also a priority. A number of IEA member countries wish to retain and improve the nuclear option for the future, at the highest available safety standards, because nuclear energy does not emit carbon dioxide. Renewable sources will also have an increasingly important contribution to make.

Improved energy efficiency can promote both environmental protection and energy security in a cost-effective manner. There are significant opportunities for greater energy efficiency at all stages of the energy cycle from production to consumption. Strong efforts by governments and all energy users are needed to realise these opportunities.

Continued research, development and market deployment of new and improved energy technologies make a critical contribution to achieving the objectives outlined above. Energy technology policies should complement broader energy policies. International co-operation in the development and dissemination of energy technologies, including industry participation and co-operation with non-member countries, should be encouraged.

Undistorted energy prices enable markets to work efficiently. Energy prices should not be held artificially below the costs of supply to promote social or industrial goals. To the extent necessary and practicable, the environmental costs of energy production and use should be reflected in prices.

Free and open trade and a secure framework for investment contribute to efficient energy markets and energy security. Distortions to energy trade and investment should be avoided.

Co-operation among all energy market participants helps to improve information and understanding, and encourages the development of efficient, environmentally acceptable and flexible energy systems and markets worldwide. These are needed to help promote the investment, trade and confidence necessary to achieve global energy security and environmental objectives.

The "Shared Goals" were adopted by IEA Ministers at their 4 June 1993 meeting in Paris.

ANNEX III

GLOSSARY AND LIST OF ABBREVIATIONS

In this report, regularly used terms and names have been written out on first mention and subsequently abbreviated. This glossary provides a quick reference for many for the abbreviations used.

ADB	Asian Development Bank
AMDAL	Analisa Mengenai Dampak Lingkungan (Environmental Impact Assessment)
BAKOREN	Badan Koordinasi Energi Nasional (National Energy Co-ordination Board)
BAPEDAL	Badan Pengendalian Dampak Lingkungan (Environmental Impact Management Agency)
BAPEDALDA	Badan Pengendalian Dampak Lingkungan Daerah (Local Environmental Impact Management Agency)
BAPPENAS	Badan Perencanaan Pembangunan Nasional (National Development Planning Agency)
BAPETEN	Badan Pengawas Tenaga Nuklir (Nuclear Energy Regulatory Agency)
BATAN	Badan Tenaga Atom Nasional (National Atomic Energy Agency)
BP MIGAS	Badan Pelaksana Kegiatan Usaha Hulu Minyak dan Gas Bumi (Executive Agency for Upstream Oil and Gas Activity)
BPH MIGAS	Badan Pengatur Hilir Minyak dan Gas Bumi (Regulatory Agency for Downstream Oil and Gas Activity)
bpd	barrels per day
CBM	coal bed methane
CCGT	combined-cycle gas turbine
CCS	carbon capture and storage

CDM	clean development mechanism (under the Kyoto Protocol)
CFL	compact fluorescent lamp
CHP	combined heat and power. When referring to industrial CHP, the term co generation is sometimes used
CNG	compressed natural gas
CO	carbon monoxide
CO_2	carbon dioxide
CTL	coal-to-liquids
DGE&EU	Directorate General of Electricity and Energy Utilization
DGMC&C	Directorate General of Minerals, Coal and Geothermal
DGO&G	Directorate General of Oil and Gas
DME	dimethyl ether
EIA	Energy Information Agency (Agency of the US Department of Energy)
EOR	enhanced oil recovery
EU	European Union
FDI	foreign direct investment
GDP	gross domestic product
GHG	greenhouse gas
GTL	gas-to-liquids
Gt	gigatonnes (1 tonne x 10^9)
GW	gigawatt (1 watt x 10^9)
GWh	gigawatt-hour
I&M	Inspection and Maintenance
IAEA	International Atomic Energy Agency

IEA	International Energy Agency whose Member countries are Australia, Austria, Belgium, Canada, the Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Japan, Luxembourg, the Netherlands, New Zealand, Norway, Poland, Portugal, Spain, Slovakia, Sweden, Switzerland, Turkey, the United Kingdom, the United States.
IGCC	integrated gasification combined cycle
IMF	International Monetary Fund
IOC	international oil company
IPCC	Intergovernmental Panel on Climate Change
IPP	independent power producer
kt	Thousand tonnes (1 tonne x 10^3)
kW	kilowatt (1 watt x 10^3)
kWh	kilowatt-hour
J	joule; a joule is the work done when the point of application of a force of one newton is displaced through a distance of one metre in the direction of the force (a newton is defined as the force needed to accelerate a kilogram by one metre per second). In electrical units, it is the energy dissipated by one watt in a second.
LNG	liquefied natural gas
LPG	liquefied petroleum gas
MDG	Millennium Development Goal
MEMR	Ministry of Energy and Mineral Resources
Mt	Million tonnes (1 tonne x 10^6)
Mtoe	Million tonnes of oil equivalent
MW	Megawatt (1 watt x 10^6)
MWh	Megawatt-hour
NEA	Nuclear Energy Agency
NIMBY	not-in-my-backyard
NGL	natural gas liquids

NOC	national oil company
NOx	nitrogen oxides
OCGT	open-cycle gas turbine
ODI	overseas direct investment
OECD	Organisation for Economic Co-operation and Development
OPEC	Organization of the Petroleum Exporting Countries
PDS	public distribution systems
PM-10	Particulate matter less than 10 micrometres
PPA	power purchase agreement
PPP	purchasing power parity
PSC	production-sharing contract
PUSDATIN	Pusat Data dan Informasi (Centre for Energy & Mineral Resources Data and Information)
R&D	research and development, especially in energy technology, and may include the demonstration and dissemination phases as well
RE	renewable energy
SOx	sulphur oxides
SO_2	sulphur dioxide
SPP	small power producer
TCF	Tera cubic feet
TFC	total final consumption
toe	tonne of oil equivalent, defined as 10^7 kcal
TW	Terawatt (1 watt x 10^{12})
TWh	Terawatt-hour
UN	United Nations Organisation
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme

UNFCCC	United Nations Framework Convention on Climate Change
USD	United States dollar
VSPP	very small power producer
WEM	World Energy Model
WHO	World Health Organisation
WTI	West Texas Intermediate
WTO	World Trade Organisation

Annex IV

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IEA Publications
9, rue de la Fédération
75739 Paris Cedex 15, France
61 2008 25 1P1 - ISBN: 978-92-64-04828-7
Printed in France by Maulde et Renou Sambre
2008