

## Global Energy & Materials



# Ten ideas to reshape Indonesia's energy sector

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Indonesia is a resource-rich county with a young and large population, and a growing economy. But the nation is being let down by its energy sector. In this paper, we present ten ideas for reshaping the sector – from the well debated to the more creative.

Indonesia has significant energy resources but is failing to exploit them fully

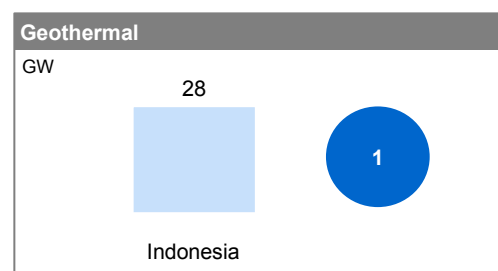
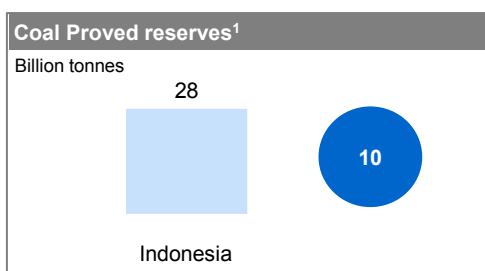
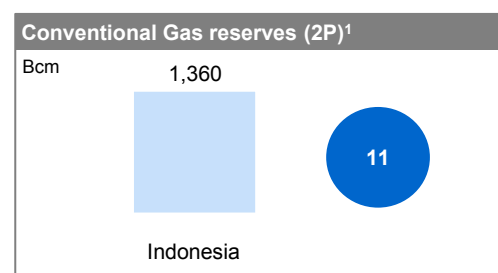
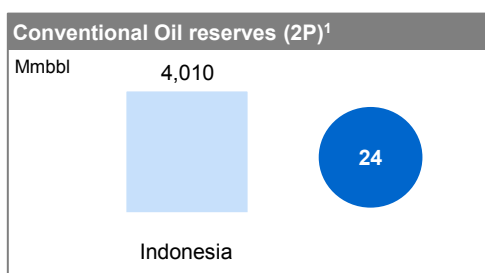
Indonesia has significant energy resources, starting with oil – it has 22 billion barrels of conventional oil and gas reserves, of which about 4 billion are recoverable. That's the equivalent of about 10 years of oil production and 50 years of gas.<sup>1</sup> It has about 8 billion barrels of oil-equivalent of coal-based methane (CBM) resources. It has 28 billion tonnes of recoverable coal. It has 28 gigawatts (GW) of geothermal potential (Exhibit 1).

And it has even more in the form of solar, wind, biomass and biofuel potential.

Yet all is not well. Indonesia's domestic oil consumption has grown from 1.2 million barrels per day in 2003 to 1.6 million barrels per day in 2013. It is projected to grow by 5 to 6 per cent through 2030, at which time Indonesia will be importing 75 per cent of its oil. Given that energy prices have increased around fourfold in the past 15 years, it would appear that in the next 15, Indonesia may become more vulnerable to future supply or price shocks.

Indonesia's reserves potential

xx Global ranking



<sup>1</sup> As of end of 2013

SOURCE: Rystad Energy U Cube, July 2014, Geothermal Energy Association; US Department of Energy; Emerging Energy Research (IHS); World Geothermal Congress; Energy Information Administration (EIA); BP Statistical Review of World Energy 2014

<sup>1</sup> Includes recoverable resources of oil and gas yet to be discovered.

Indonesia's electricity demand has grown from 90 terawatt-hours (TWh) in 2003 to 190 TWh in 2013. However, supply has not kept pace with demand, with regular shortages as a consequence. The solution has been to rely on fuel oil; 13 per cent of Indonesian power comes from oil products. However power from fuel oil is expensive, at about \$0.18 cents/kWh versus about \$0.05 cents/kWh for coal.<sup>2</sup> Only 1 GW of the country's geothermal potential has been built. The shortage of a reliable, cost-effective source of power threatens to hamper industrial growth and the build-up of a manufacturing sector on the same scale as its neighbouring countries.

Turning around the energy sector will require bold moves, difficult decisions and significant investment. We have identified ten ideas that could help reshape Indonesia's energy sector and unleash sustained growth in the decades ahead.

#### 1. Find the political will to reduce energy subsidies:

The scale of Indonesia's fuel subsidies is well known - about \$30 billion each year. To put this in perspective, that exceeds government spending on healthcare and education combined. It is also roughly equivalent to the cost of building 31,000 kilometres of new roads; 2,000 class-C hospitals; or three world-scale refineries per year. If maintained at this level, we estimate that the amount spent on Indonesia's energy subsidies would actually be sufficient to cover all its infrastructure needs between 2011 and 2025, about \$200 billion according to the government's economic development master plan.

Another effect of the subsidies is that it does not allow for the development of an efficient energy sector. Energy sources that would otherwise be attractive are not developed because the pricing in the market is distorted. For example, geothermal—with real market-based pricing—would already have been a much greater part of the mix, if subsidies were not present.

Reducing these subsidies is a matter of political will. We recognise that there is a significant part of the population for whom subsidies must continue.

However, providing direct subsidies to those in need - rather than the whole population - would ensure that those on low incomes are protected, while vital funds can be freed up for spending on health, education, and infrastructure which will accelerate Indonesia's longer-term growth.

We would also encourage removing these subsidies quickly rather than in steps over time. We have seen in other countries that each phase tends to be met with significant resistance from interest groups, and sometimes the political will dissipates over time.

#### 2. Address the root causes behind the slow expansion of power generation capacity:

The Indonesian power industry is highly inefficient; the government provides large subsidies to consumers by keeping prices low, with the result that power producers' revenues currently cover only two-thirds of production costs. The programme to build out generation capacity is behind schedule. For example, in 2011, oil-generated power was projected to be 5 per cent of the total by 2013, but as mentioned the actual number was 13 per cent. The programme has been hampered by challenges with land clearance, permits, and contractor capabilities. There are many factors behind this, but at the root is a complicated system that doesn't align the needs and incentives of regional and central politicians and bureaucrats, relevant ministries, independent power producers (IPPs) and PLN, the state-owned national power company.

While the power-generation market can accommodate IPPs, PLN remains the dominant integrated player and sometime self-regulator with a largely standard model of pricing and delivery across the archipelago. There is an opportunity to review the existing industry structure not only to encourage competition but also to address the needs of regional governments and other stakeholders that would like to improve power infrastructure. Many countries have successfully separated the role of regulator from that of operator in the power sector, with significant benefits to both the industry and consumers. Regional tariffs or pricing differentiation could also be considered.

<sup>2</sup> All figures stated in this report are in U.S. dollars.

For example, the central government could opt to subsidise only lower-level residential users with the option for regional governments to “top up” the subsidy (when needed) if they wish.

Indonesia's power-supply business plan (RUPTL) outlines a goal of increasing generation capacity from 42 GW at the end of 2013 to around 90 GW by 2022, while also almost eliminating the use of expensive fuel oil. An initiative to address these challenges has already been started by the President's Unit for Supervision and Management of Development (UKP4) and the Indonesian Ministry of Finance. That initiative needs to be resourced, maintained and strengthened, and ideally, given the necessary mandate to make things happen.

**3. Introduce tailored incentives for oil and gas exploration and development, including unconventional:** Indonesia needs big discoveries and new developments in the oil and gas sector, but it is currently underinvesting in exploration and development. The data paints a sobering reality. Oil reserves have declined from 5.6 billion barrels in 1992 to approximately 3.6 billion barrels today.

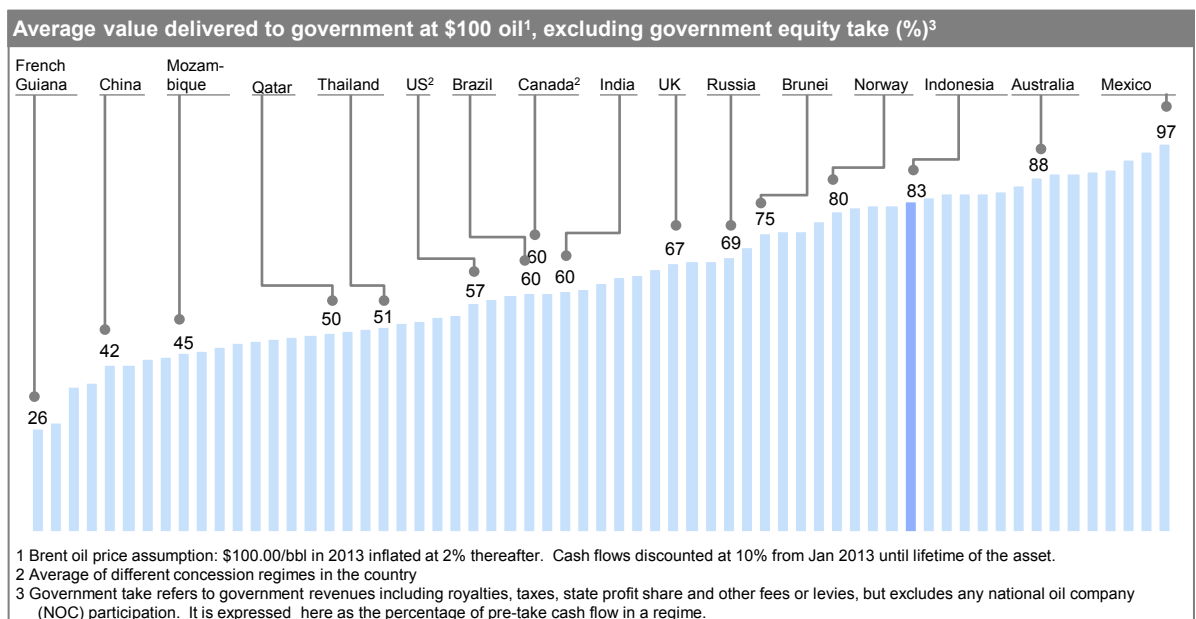
In 2012, the reserve replacement ratio for oil was 52 per cent, compared with 127 per cent for gas. Despite sustained high oil prices and increasing natural gas prices, exploratory drilling has been in decline, and only about 50 per cent of planned exploration wells are drilled in Indonesia in any given year.

Although industry experts continue to see potential in Indonesia's resources sector, a number of challenges remain. The fiscal regime for conventional resources is among the most punitive in the world. In fact, the government “take” or the proportion of value delivered to government from oil and gas projects in Indonesia is 82.7 per cent (Exhibit 2).

The effect is to reduce Indonesia's attractiveness to local and foreign companies relative to other countries. Indonesia should consider selectively incentivising new exploration and development. Malaysia has been successful with this over the years. For example, new risk-sharing contracts have attracted new companies to join in the development of reserves.

### Benchmark of concession regimes across the world

SELECTED COUNTRIES



SOURCE: Wood Mackenzie Global Economic Model

In addition to the well-known challenges of corruption and collusion, industry players also suggest that the regulatory environment continues to delay development and adds unnecessary costs and time to production. Lack of clarity over the implementation of Law 22 (which details the oil and gas regulatory framework in Indonesia) and concerns over the sanctity of contracts present additional challenges.

To reverse declining production, Indonesia should do three things: 1) create additional incentives for exploration and unconventional development; 2) uphold all legal contracts and clarify implementing regulations; and 3) tackle corruption across the system.

**4. Accelerate the national gas infrastructure 'blueprint':** Indonesia was a pioneering liquefied natural gas (LNG) exporter in the 1970s, producing more gas than its domestic market required. It has continued to export LNG from its well-known LNG producing facilities such as Arun, Bontang and Tangguh. Looking ahead, the major upstream projects in Indonesia are also in the gas sector, including, for example, Donggi Sonoro, Indonesia Deepwater Development (IDD), Jangrik, and Masela.

Natural gas clearly has an important role to play in Indonesia's energy future. Over the past two decades, however, no significant new onshore gas fields have been developed to replace the large declining gas fields in West Java and South and Central Sumatra. While natural gas is produced in Kalimantan, Sulawesi and Papua, this gas cannot currently supply Java because of insufficient transmission infrastructure including a deficit of pipelines and regasification terminals. As the local sources of gas in Java and South Sumatra decline, Indonesia will need new LNG regasification infrastructure in Java and Bali along with transmission pipelines to link the key markets in Java with gas sources in Eastern Indonesia. This will require investments of roughly \$2 billion.

In Eastern Indonesia, "mini LNG" plants (small-scale facilities that allow smaller fields to be developed)

can be used to supply gas from emerging sources to islands across the archipelago in an efficient manner along with "modular power" (small-scale power generating units that can even be moved after the fuel source has been exhausted). PLN has several small-scale power plants that run on diesel and fuel oil. Conversion of those plants to gas would drive higher efficiency and lower costs. In addition, several upstream producers in Indonesia "flare" or burn significant quantities of gas because of inadequate infrastructure, causing losses of around \$100 million every year to the country. This gas can be converted into local power supply through new technology providers.

Accelerating the 'gas infrastructure blueprint' for Indonesia should be a top priority for the new government.

**5. Upgrade existing refineries as soon as possible:** Indonesia's five major oil and gas refineries lose roughly \$1 billion per year at current market prices. Even if the refineries are operated perfectly, they will still continue to lose almost as much. The reason is their configuration—the way they were built. Given their age, simple technology, and the fact that they were built for Indonesian sweet and light crudes, their configuration is no longer fit for purpose. The end result is that the refiners' gasoline and diesel are much more expensive to produce than imports.

To drive competitiveness and profitability, the refineries need to be significantly upgraded. The total capital expenditure for this is in the order of \$12 billion to \$17 billion. These refinery upgrades compare very favourably to the alternative of developing entirely new refineries. They offer the potential for two to three times greater gasoline and diesel production for the same size investment. The economic returns are much higher than greenfield development as a result of pre-existing investments in infrastructure and land. These upgrades have the potential to be some of the highest value-creating projects in the country. And they have the potential to double the domestic supply of bahan bakar minyak (BBM or oil fuels).

**6. Upgrade the fuel distribution network:** Indonesia has one of the most complex fuel-product supply chains in the world due to its geography (an archipelago of over 17,000 islands) and population distribution. The country also relies on imports of finished fuels from other regional markets, and will likely continue to do so. Indonesia needs to invest aggressively in upgrading its fuel infrastructure network, storage facilities and fuel tanker fleet to ensure their continued reliability and efficiency.

Given this background, Indonesia should consider three things: 1) invest in increased storage capacity to take advantage of blending and trading opportunities, while at the same time making the country less vulnerable to price fluctuations; 2) continue to roll out state-of-the-art technology such as automated high-throughput gantries, centrally controlled operations and real-time data management; 3) take advantage of its geographic location and become an oil and gas trans-shipment and trading hub, following the examples of Singapore and Johor.

**7. Invest in renewables:** Indonesia's planned fuel mix is designed to achieve least-cost production by maximising the percentage of coal and gas in the mix. Coal and gas are supposed to account up to 84 per cent of total electricity production by 2017. However, there is also an opportunity to increase the contribution from renewables in the fuel mix, with geothermal, hydro and biomass, in particular. The estimated geothermal potential is up to 27 GW versus an installed capacity of approximately 1 GW, while the hydro untapped potential for the country is approximately 70 GW. Solar has lower potential, but still has potential, particularly in East Indonesia where the yield is higher. Some of these technologies, including biomass, will require further advancement in technology to become economically viable. Others, such as solar are not yet competitive at scale and to achieve grid parity, but can be an economically viable option for distributed generation compared with the very expensive fuel oil and distillate (both

have comparable levelised costs of energy<sup>3</sup> of approximately 2,300 -2,500 Rupiah/ kilowatt).

Geothermal energy is competitive in several regions, but increased tariffs for geothermal need to be agreed to incentivise upstream producers to invest along with accelerating licenses and permits. To actively encourage adoption of renewable energy technologies, the government could introduce practical feed-in-tariffs by region and accelerate the issuance of licenses and permits.

**8. Invest in gas for transport:** Rapid urbanisation and economic development is driving significant growth for transportation vehicles in Indonesia's largest cities. This has resulted in a significant expansion of fuel subsidies as these vehicles consume gasoline and diesel, while also creating air pollution in the cities. Using compressed natural gas (CNG) for vehicles is an attractive option which would both reduce subsidies and improve air quality. It has been implemented successfully in several Asian cities, including New Delhi, Mumbai and Bangkok. In Indonesia, this would require an integrated approach combining several elements: 1) economic incentives for consumers, producers and marketers; optimal pricing would be required for diesel to ensure that consumers recover their investment to convert their vehicles within 12 months; 2) producers and suppliers making adequate returns on their investments; 3) marketers being able to create appropriate margins; 4) support of regulations mandating the switch to CNG for transportation vehicles; and 5) setting up critical infrastructure to enable installation of converter kits and gas stations for refuelling at convenient locations.

Indonesia should target converting approximately 250,000 public transport vehicles in the next five years. We estimate that could save the country up to \$2 billion in subsidies.

Gas as a transportation fuel is also relevant in the shipping sector. One of the major challenges in the Indonesian archipelago of over 17,000 islands

<sup>3</sup> Computed cost of generating electricity based on operating cost and annualizing capital expenditure over the lifetime of a power plant.



is transporting goods and people across the country. This requires a domestic shipping fleet in the range of around 2,000 ships, which consume nearly 7000 barrels/day of bunker fuel. With the rapid technological advances in mini and micro LNG, Indonesia could convert large sections of its domestic shipping fleet to LNG. Converting just 10 per cent of the fleet to LNG could potentially result in around \$100 million in annual cost savings. This would require coordinated action since LNG fuelling facilities will need to be established at the major ports; economic incentives will need to be offered to shipping operators; and supporting regulations will need to be put into place for industry.

#### 9. Promote electric vehicles in major cities:

Electric vehicles (EVs) have been seen to be having significant impact as an option for land transport. This is a result of superior energy efficiency, positive environmental outcomes and business potential. EVs are especially relevant for vehicles that drive many kilometres per year within a limited geography—a city. Taxis are a great example. They drive many thousand kilometres per year, but are always close to a charging station. EVs also have much lower emissions of carbon dioxide, and zero emissions of other pollutants (nitrogen oxide, sulphur oxide, particulate matter). Large cities such as Jakarta with a highly concentrated population and high proportion of short range trips are well positioned to adopt EVs as an alternative form of transport.

With the latest advancements in battery technology, the performance, safety and cost of batteries has become manageable.

Because of Indonesia's inefficient subsidy regime, shifting to EVs would have an additional benefit of reducing the subsidy burden (cars are more energy efficient and use electric power instead of diesel/gasoline). The potential subsidy savings is 800 billion Rupiah for each lot of 100,000 vehicles converted from gasoline or diesel to electricity.<sup>4</sup>

Given that there are around 5.5 million vehicles in Jakarta alone (not including motorbikes and scooters), the potential for reduction in fuel subsidies is tremendous.

Perhaps the most important thing for Indonesia to get right is the industry leaders and capabilities across all the important areas in the energy sector.

#### 10. Build local cutting-edge capabilities and

**leaders:** Indonesia has been an energy leader at certain points in the past. For example, in establishing the production sharing contract system to develop upstream resources and setting up the then world's largest LNG export facilities in the 1970's.

Going forward, technology, capabilities and leaders are the name of the game. For example, Indonesia will need to access newer technologies and technical experts to grow its production from maturing fields using the latest enhanced oil recovery (EOR) and improved oil recovery (IOR) technologies. This is the same for unconventional technologies such as coal bed methane (CBM) and shale extraction. The upgrading of refineries requires project execution capabilities on a scale that Indonesia has not seen for decades. New coal technologies—including clean coal and coal-to-liquids have the potential to reshape the industry.

Indonesia currently has too few world-class oil and gas research and development centres to develop cutting-edge technologies. There are too few graduates ready to become oil and gas industry professionals. Indonesia therefore needs a coordinated effort to develop leading-edge capabilities in the sector, drawing on the examples from others including Norway, Malaysia and Brazil, which have successfully developed the right skills base as they have developed their own natural resources. This would require a combination of:

- Establishing international quality institutions to develop local talent including universities with international faculty and industry cooperation to ensure training is in line with industry needs; instituting training programmes at scale to

<sup>4</sup> Assuming 30,000 km/ year for each vehicle, Rupiah 5,000/l gasoline fuel subsidies, Rupiah 400/ kWh electricity subsidies, 0.25 Kwh/ km electricity consumption and 0.1 l/ km fuel consumption.

develop the 2,000-3,000 PhDs in oil and gas in the next five to ten years by collaborating with leading petroleum educational institutions in the world;

- Developing incentives for international operators and service companies to establish their R&D hubs in Indonesia focused on technologies that are relevant in the region; and
- Encouraging national champions to employ international talent in their operations as they seek to develop Indonesia's resources.

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We believe Indonesia has the resources and the people to achieve its growth aspirations. We hope that the above ideas will allow the country to unleash some of that potential. Indonesia deserves it.

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