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Secure energy supply in 2025: Indonesia's need for an energy policy strategy

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HIGHLIGHTS

- Indonesia aims at 17% renewable energy in energy mix 2025.
- Population growth exceeds increase of energy production.
- Investment incentives for new technologies, exploration and efficient production are necessary.
- Clear and comprehensive energy policy strategy and regulatory framework are crucial.

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ABSTRACT

Indonesia as an emerging country with one of the fastest growing economies requires sufficient supply with energy for national development. Domestic energy production cannot satisfy the domestic demand, and the deficiency necessitates growing imports. The present energy mix consists of 96% from non-renewable sources, i.e. fossil fuels, less than 4% from renewables. Government Regulation 5/2006 aims at increasing the proportion of renewable sources to 17%. Two scenarios for the energy situation in 2025 have been elaborated and are discussed. An overall energy policy strategy and regulatory framework covering non-renewable and renewable resources are crucial for securing energy demand.

1. Introduction

Indonesia is an archipelago country comprising approximately 17,000 islands in area of 1,904,569 km^2 of which 1,811,569 km^2 is covered by land and 93,000 km^2 is covered by water. Administratively, it is divided into 33 provinces, which consist of 440 regencies. With more than 248 million people, Indonesia is the world's fourth most populous country. It is the largest economy in Southeast Asia and a member of the G-20 major economies. Indonesia created an impressive economic growth for more than 18 years from 1980 to 1997 (the year of the onset of the Asian financial crisis), which is reflected by increasing GDP per capita Power Purchasing Parity (GDP PPP) by nearly 7.75% per year (http://www.tradingeconomics.com/indonesia/gdp-per-capita-ppp).

Indonesia's strong economic growth caused an even faster increase demand for energy. From 1980 to 2010, total primary energy production grew 2.8 times, while energy consumption grew to almost five times. In 2010, approximately 96% of the national energy mix was dominated by fossil fuels. The renewable sources, mainly hydropower and geothermal energy, amounted to less than 4%. Total energy demand in 2025 is predicted to be nearly 3 times higher than in 2010. The problem of natural depletion of non-renewable resources, particularly oil, and their compensation has to be solved. The Indonesian Government Regulation No. 5/2006 tries to cope with this situation by aiming at the energy mix 2025: oil < 20%, gas 30%, coal 33%, renewable resources > 17%, that is bio-fuel (5%), geothermal energy (5%), biomass, nuclear power, hydropower, solar energy (5%) and coal-liquefaction (2%). However, changing conditions since 2006 have caused amendments. In order to secure the energy supply in 2025, a deliberately balanced use of non-renewable and renewable energy resources is crucial. Challenges like increasing the availability of renewable energy resources, establishing grids of energy supply under difficult transport conditions and fostering consumption of renewable energy sources can only be managed by establishing a clear and comprehensive energy policy strategy and framework based on an appropriate energy mix.

The paper is structured as follows: Section 2 discusses the relationship of economic growth and energy consumption, Section 3 provides data of energy resources, reserves, production and consumption. Section 4 describes national energy supply policies based on the Government Regulation No. 5/2006 on National Energy Policy. Section 5 provides an overview of the regulatory and legal framework. Section 6 analyses and discusses the main

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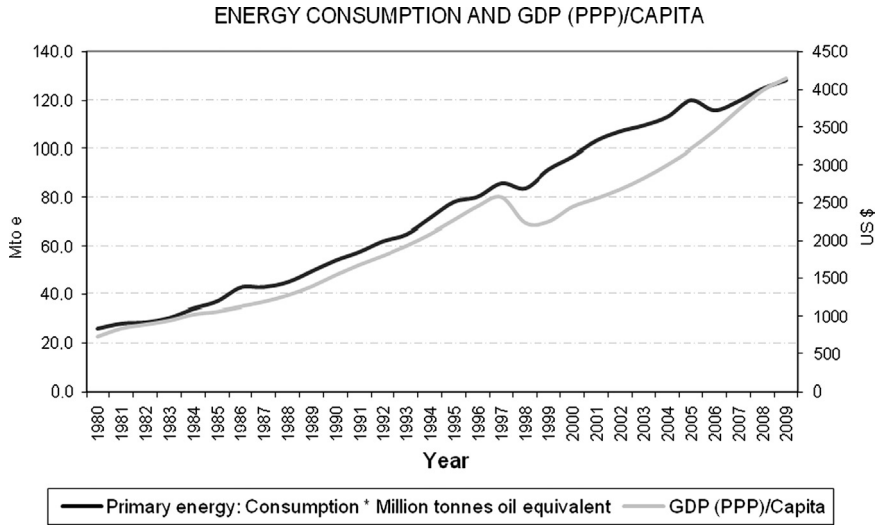

Fig. 1. Energy consumption and GDP(PPP)/capita in Indonesia 1980–2009.
Source: BP Statistics (2010).

issues and challenges related to energy supply mix presently and targeted in 2025. Finally, Section 7 includes the conclusions.

2. Economic growth and energy consumption

Energy consumption increases along with economic growth, which is reflected by GDP per capita. Masih and Masih (1996) analysed and confirmed the relationship of energy consumption and economic growth of Indonesia from 1955 to 1990. Data from 1980 to 2009 in Fig. 1 indicate the parallel development of GDP and energy consumption, with the consumption line exceeding the GDP line until 2008.[1]

2.1. Production versus consumption (1980–2009)

While energy production grew to 2.8 times within 30 years, energy consumption grew to almost 5 times. Total energy production from non-renewable energy resources increased from 90 million tonnes oil equivalent (MTOE) in 1980 to 269 MTOE in 2009 (Figs. 2 and 3). Total primary energy consumption was 25.8 MTOE in 1980 and reached 128.2 MTOE in 2009. Although total primary energy production is still higher than total domestic energy consumption, the consumption upward trend is evident. Therefore it is an important policy issue to balance domestic demand and exports of gas and coal (see Sections 4–6).

3. Energy resources, reserves, production

3.1. Non-renewable sources

Indonesia has a wide variety of abundant energy resources. Its economy was based on export of non-renewable resources for more than four decades (Yusgiantoro, 2000), when in 2004 the country became to a net oil importer. With increasing domestic energy need the export potential of coal and gas was also reduced, which is reflected in the 'New policy on domestic energy supply obligation' (see Sections 4 and 5). The non-renewable energy resources of oil, gas and coal are spread over the whole area of the country, mainly in 128 sedimentary basins (MEMR-Geological Agency, 2009).

Map 1 shows the distribution of Indonesia's energy resources. Tables 1–3 show the amount of non-renewable energy resources proven reserves and production[2] as of end of 2010.

3.1.1. Oil and gas

Since the first discovery of oil in 1885, Indonesia's oil and gas sector has made a substantial contribution to the economic development of the country. In 2002, the known Indonesian oil reserve represented about 1% of the total world reserves. The rate of oil exploitation of 1.5 million barrels a day seemed to be responsible for bringing about depletion in the near future, but then 60 newly discovered hydrocarbon basins offered the prospect of compensating the rapid exploitation of the oil fields (Suryantoro and Manaf, 2002). After the Asian Crisis of 1998 and the new oil and gas law of 2001 (see also Section 5), investment in exploration of new fields declined and the sector shrank by 3.6% in 2010 (data of Central Statistics Agency, in Global Business Guide Indonesia (GBGI), 2011). At present, oil production is declining by 12% every year. This is attributable to ageing fields and a lack of exploration. Indonesia still has huge reserves of oil and gas, particularly in the eastern part, where large deep sea deposits have been discovered.

Indonesia has the largest reserves of natural gas in the Asia Pacific region at 108.4 trillion cubic feet (3.1 trillion cubic meter) of proven reserves at the end of 2010; this is three times that of its oil reserves. In the region of Minas and Duri on the east coast of Sumatra the two largest oil fields by production are maturing with over 80% of reserves realised for both. Presumably, the largest potential gas reserves are situated in the same region. So far, only one third of known gas basins have been explored.

[1] During the Asian Crisis of 1997–1998 energy consumption and GDP decreased by −13.45%. Another drop of energy consumption during 2005/2006 had no impact on economic growth. After a period of steadily growing GDP (2000–2008), at a rate of 3.8% in 2000–2001 to 6.4% in 2006–2007, GDP growth slowed down to 4.6% in 2008–2009 due to the international economic crisis. The highest energy consumption growth amounted to 12.24% in 2008–2009; the lowest was negative in 2007–2008 (−5.4%). Since then, GDP has been growing and is predicted to reach 6000 US $/c in 2016 (IMF, 2010/TradingEconomics.com). GDP Power Purchase Parity (GDP PPP) rose from 726.51 US$/capita (UD$/c) in 1980 to 4150 US$/c in 2009.

[2] Non-renewable energy production. Gas production increased from 16.7 MTOE in 1980 to 64.7 MTOE in 2009, coal production increased from 0.24 MTOE in 1981 to 155.3 MTOE in 2009. In contrast, oil production decreased from 79.03 MTOE in 1980 to 49.0 MTOE in 2009.