

Indonesia Power Greenness Index in 2035

Background

Indonesia's economy is the largest in Southeast Asia, with a GDP estimated at \$932 billion in 2015. Since 2010, Indonesia's GDP growth rate has averaged at about 5 % annually. Moreover, the country's population increase has remained more than 1% annually. Because of its fast economic and population growth, Indonesia's demand for electricity grew at a relatively high rate at 5% since 1995. There was an increasing electricity consumption at 6.3% per year from 2010 – 2014. However, the installed capacity in Indonesia is always below the energy demand. Therefore, it is meaningful to examine the energy demand by different regions across the entire country. This project will focus on the increase of energy demand in different areas of Indonesia and its impact. It will explore the following questions: 1. Which provinces in Indonesia will have energy shortage in 2035? 2. Which provinces are more vulnerable to pollution as a result of reliance on fossil fuels? 3. Which provinces will remain "green" in 2035 because of its sustainable power development plan?

Methodology

Population, GDP growth and wage growth are three major variables that affect a region's future energy growth. In order to make projections of Indonesia's energy demand in 2035, I used the field calculator to rank the growth in population, GDP and wage of each province from 1-5, and assigned different weights (40%, 40% and 20% respectively) to each variable and add them up. The data is extracted from Indonesia's census data projection for each province in 2035. After projecting the World Power Plant dataset, I summarized the total installed capacity in each province. Then, I divide the energy demand indicator in 2035 by the current total installed capacity in each province to generate the Indonesia Energy Shortage Index 2035. Secondly, after summarizing installed capacity of different fuel types in each province, I used the same metrics to rank each province's environmental vulnerability from 1-5. Regarding different environmental impact of different fuels, I assigned 70%, 20% and 10% to coal, oil and gas power plants respectively. Finally, I multiply the previous two indicators to visualize the Indonesia Power Greenness indicator 2035. As a province becomes greener, it will have less demand for traditional energy and renewables are likely to become its primary energy source.

$$\text{① Energy Shortage Index 2035} = (40\% * \text{Population Growth} + 40\% * \text{GDP Growth} + 20\% * \text{Wage Growth}) / (\text{Installed Capacity in 2015})$$

$$\text{② Environmental Vulnerability} = 70\% * \text{Coal mix} + 20\% * \text{Oil mix} + 10\% * \text{Gas mix}$$

$$\text{①} * \text{②} = \text{Power Greenness 2035}$$

Results

The results show that Indonesia will face tremendous energy shortage across the entire country, reinforcing the World Bank's predictions. Principally fueled by the considerable population growth, most Provinces on the Sumatera island, Central Kalimantan, East Nusa Tenggara, West Sulawesi and West Papua will face severe energy shortage in 15 years. In terms of the environmental vulnerability, Aceh, South Sumatra, Banten, Lampung, Central Kalimantan, North Kalimantan, South Kalimantan, Central Sulawesi and South Sulawesi currently suffer from serious pollution. This is mainly because these provinces use coal as their primary source of energy. Finally, combining the two calculations together, we can observe that the provinces in the central part of the Sumatera island, most provinces in the Java island and the Sulawesi island are greener than the rest of the country. Particularly, these three provinces—Bangka Belitung, Riau and West Kalimantan — will remain green in 15 years even if will high energy demand, mainly due to its reliance on the renewable energy. In contrast, since they will have high energy growth and will rely on fossil fuels, Aceh, Lampung and Central Kalimantan will face increasing environmental challenges in the next decade.

Challenges

My analysis faces several challenges. First, the biggest assumption of this project is that energy mix for each province will stay the same in the next decade. Although the existing resources suggest energy mix will unlikely to change in each province of Indonesia over a short period of time, assuming the current energy mix will not change at all in the next decade is not accurate. Moreover, in the real world, the amount of power generated by a province will likely be transmitted to its neighboring regions if it cannot consume it all. Thus, the amount of electricity generated in each province does not fully reflect its current energy supply. Future research should find more accurate data on the issues noted previously. Lastly, it will be more effective to use country-wide air pollution data to conduct the environmental vulnerability analysis, which unfortunately does not exist so far.



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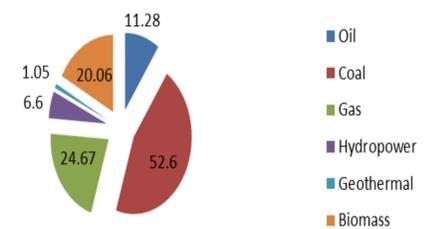
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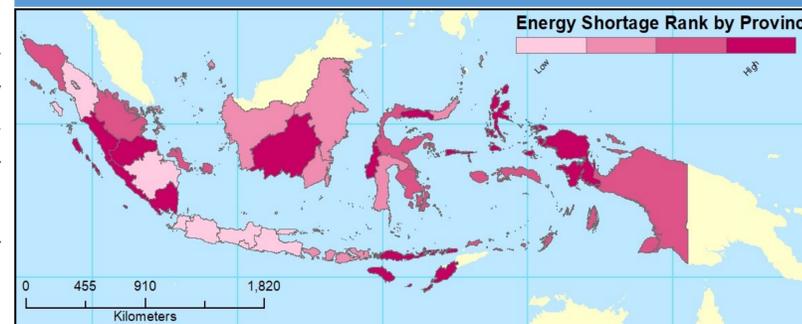
Supply of Electricity production by Fuel Type, 2017



Data Sources

GADM, Badan Pusat Statistik (BPS - Statistics Indonesia), World Resource Institute

Energy Shortage Index in 2035 by Province



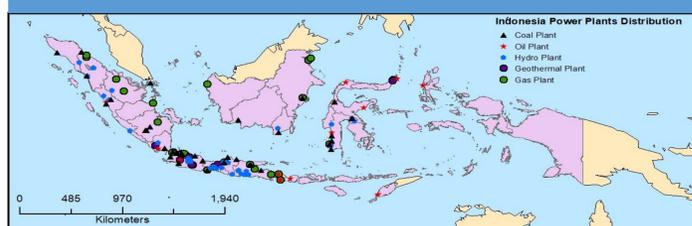
Environmental Vulnerability Index in 2035 by Province



Indonesia Greenness Index in 2035 by Province



Indonesia Power Plant by Fuel Type 2017



GDP Growth in 2035 by Province



Population Growth in 2035 by Province



Wage Growth in 2035 by Province

